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JOURNAL OF THE MILITARY SERVICE INSTITUTION

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WILLIAM L. HASKIN, Editor First Part.

Authors alone are responsible for opinions published in the Journal.

JAMES C. BUSH, Editor Second Part.

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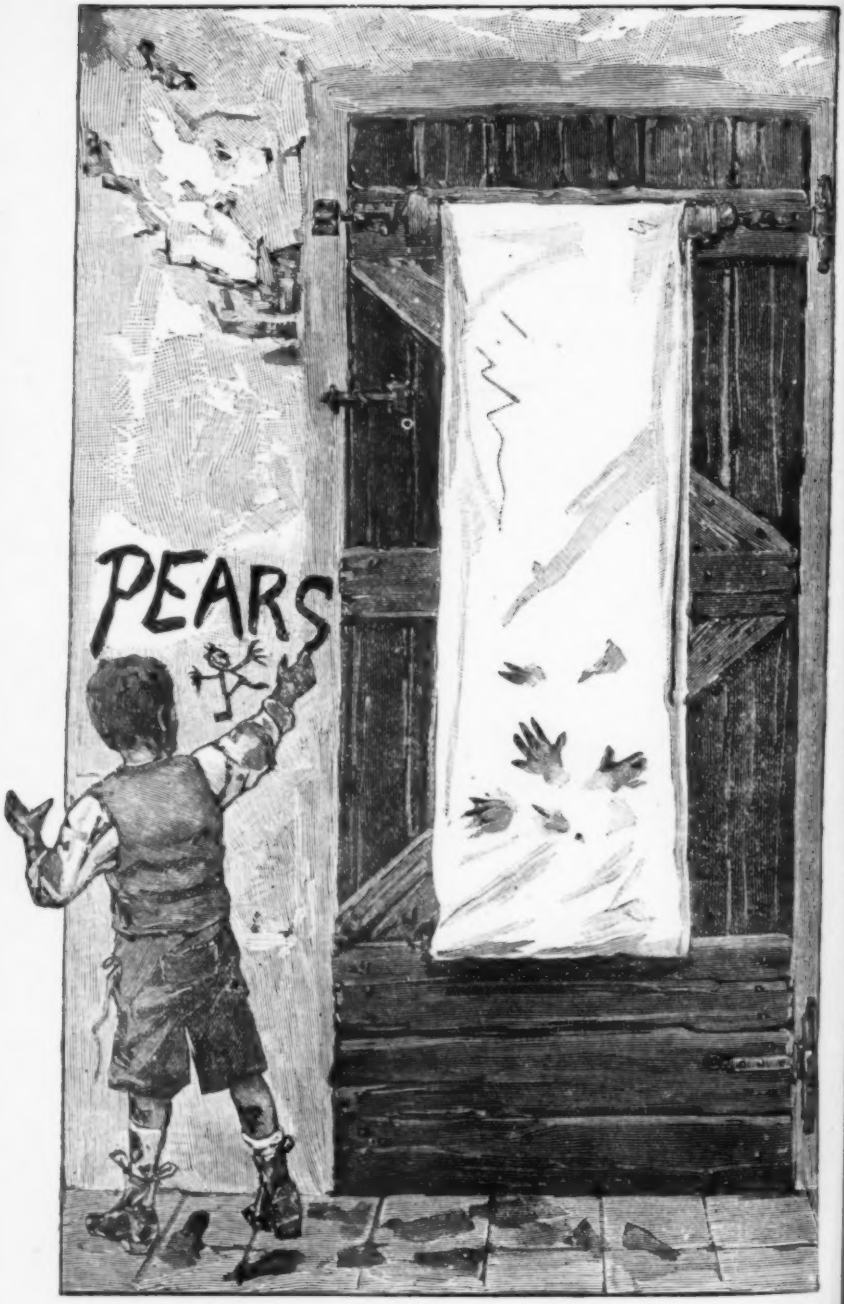

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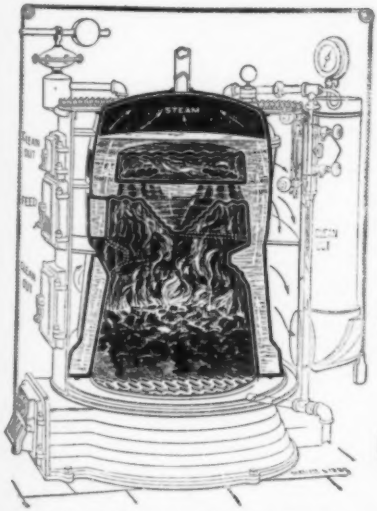

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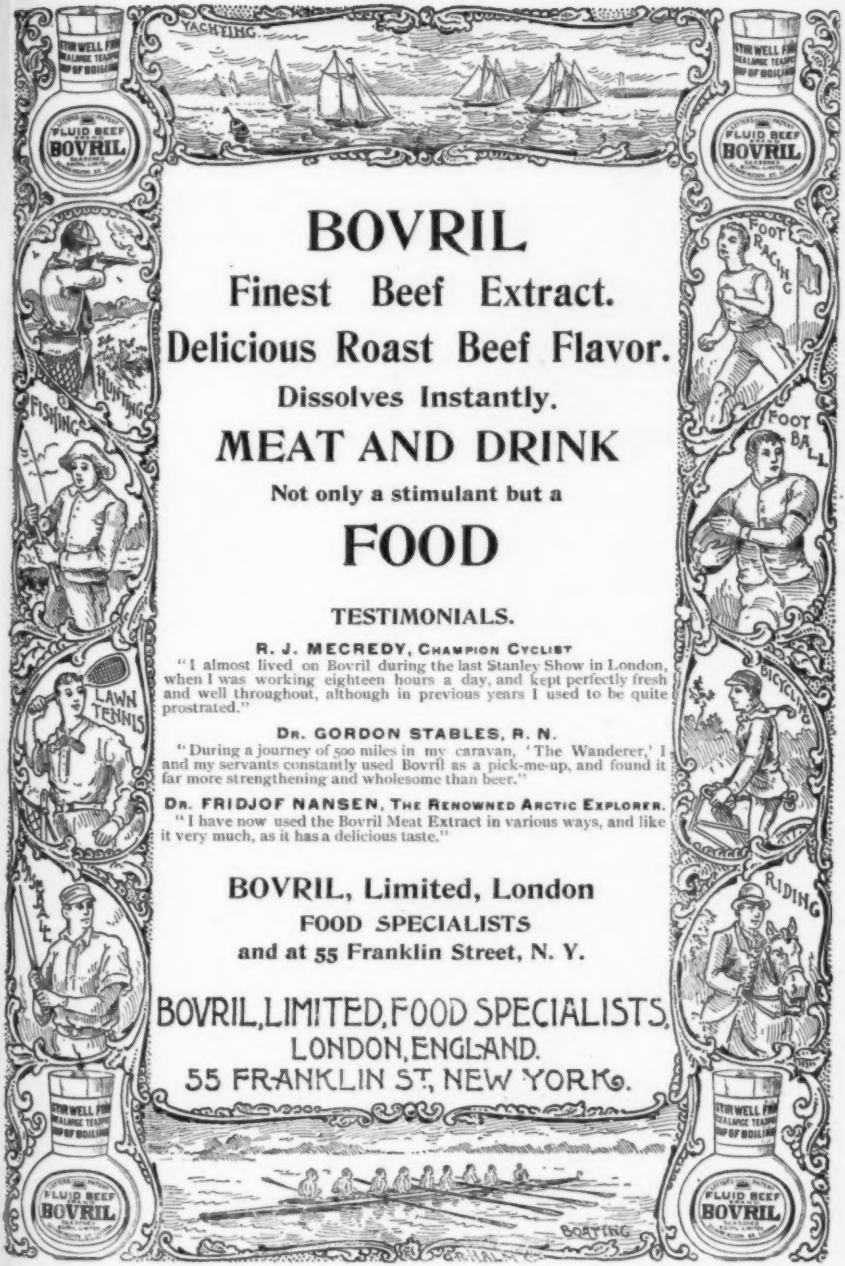

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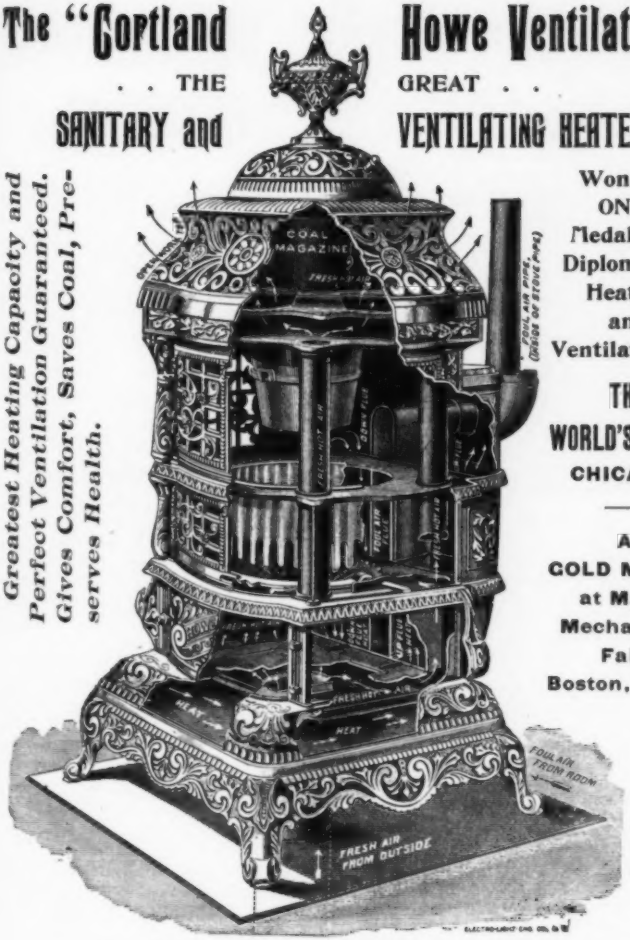

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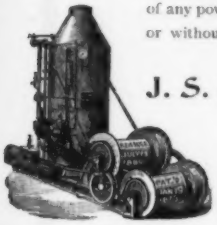

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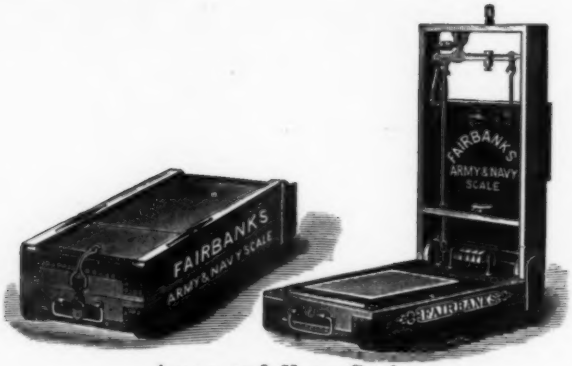

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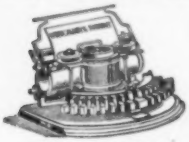

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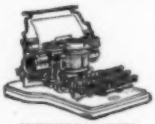

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VOL. XV. JULY, 1894. NO. LXX.

AMERICAN MILITARY ROADS AND BRIDGES.*

BY PROF. P. S. MICHIE, U. S. MILITARY ACADEMY.

THE United States, by reason of its fortunate situation, its free institutions, its vast resources, and constantly increasing population, is happily free from the necessity of maintaining a large standing army and of devoting any considerable portion of its revenues to the expensive art of war. In the ordinary acceptation of the term it cannot therefore be regarded as a military nation. It presents a strong contrast to the powerful military states of Europe; for its immediate neighbors, both north and south, are friendly and peaceable people, whose armed forces are as insignificant in numbers as are those of her own. Year by year, as her population approaches the round hundred million, the possibilities of war become more and more remote with even the most powerful nation on the globe. Throughout the extensive domain that acknowledges its sovereignty, the sentiments of loyalty to the existing constitutional government are continually being strengthened and a more perfect homogeneity developed among its people. To all present appearances there seems to be no reasonable apprehension that any question can

* Read before the International Congress of Engineers at Chicago, and published in the JOURNAL by permission of the late Maj. Clifton Comly, Chairman of the Division of Military Engineering.

arise in the near future that will divide her citizens into two hostile parties separated by geographical boundaries. The thorough intermingling, caused by social and commercial interests, aided by the abundant means of intercommunication, the rapid interchange of opinion, and the frequent opportunities for political decision on all national questions, tends to make the political machinery move with the least possible friction.

From this preliminary statement, the truth of which is manifestly self-evident to the most casual observer, it is not surprising that, since the termination of the rebellion, there is little progress to be noted in anything relating to the military profession in this peace-loving country. Prudential considerations, however, have forced the nation to devote its attention of late to the subjects of modern war-ships and great guns in order that its vulnerable coast line may be, in some measure, protected.

With regard to the subject of "Military roads and bridges from an American standpoint," upon which I have been requested to submit a paper, I am at a loss to find anything of interest to say, whether new or old. Strictly speaking, we have never had any military roads in this country, and we owe the purely military bridges that have from time to time been in use in our service, to the French and other military nations of Europe. Since the close of the rebellion no modification has had the benefit of experimental service, and the total bridge equipage of the U. S. Army to-day is reduced to a bridge train at West Point, employed to instruct the cadets of the United States Military Academy, and another at Willet's Point with the Battalion of Engineers, U. S. Army.

MILITARY ROADS.

From the time of the early settlements on the Atlantic seaboard until the introduction of railways, about the year 1827, the only means of communication between the outlying settlements and the towns from which they drew their supplies were mere surface roads, which, from time to time, have been improved both in character and in location as the necessity has arisen. The Regular Army of the United States, which has always been maintained at the least possible minimum strength for the multifarious duties assigned to it, has been constantly kept on the frontier of civilization to protect the ever advancing pioneer settlements. To preserve its communications, so-called military roads have been established and built by the troops under the

direction of army officers. A road was known as a *military* road when it could be used by wagons hauling supplies for the advanced military posts. In location it was often so directed as to require the minimum labor for its construction, taking advantage of such grades of the natural surface of the ground as would permit the passage of the rough wagons of that day, drawn by oxen, mules, or horses. As the country increased in population and prosperity, the traffic over many of these roads became much heavier, so that in parts, at least, they were improved in location and made of a better character by macadamizing. Examples of these earlier types of the military road are that from Detroit, Mich., to the Maumee River, constructed by Bvt. Maj. John Anderson, Topographical Engineers, in 1817; the military road through Mississippi, by Lieut. William M. Graham, Corps of Artillery, 1819–20; those in Florida to St. Augustine, by Lieuts. Lacy and Trenor, 1824, 1825 and 1826, and from the Georgia State line to Smyrna, Fla., by Lieuts. Phillips, Anderson, and Clay, Fourth Infantry, 1827–28; in Arkansas to Little Rock, by Lieut. Archer, Third Infantry, 1837, and from Fort Leavenworth, Kans., to Fort Smith, Ark., by Capt. Dimmick and Lieut. Prince, Fourth Infantry, 1837–38.

The United States possessed a vast territory west of the Mississippi River, which was greatly increased by the acquisition of other lands ceded by Mexico after the war. Most of this was an unknown wilderness, which had from time to time been pierced by adventurous explorers from 1800 to 1844, notably by Capts. Lewis and Clarke, 1804, 1805, and 1806; by Maj. Pike in 1805 and 1806, and by Maj. Long in 1819–23; by Capt. Bonneville, 1832–36; Commander Wilkes, U. S. Navy, 1838–42; Lieut. Fremont, 1842; Capt. Boone and Capt. Allen, 1843, and Josiah Gregg in 1844. From 1843 to 1852 many other army officers were detailed to continue these explorations and to locate military roads in this wilderness, and from 1852 to 1857 additional important duties were assigned to them relating to the survey and location of railway routes to the Pacific Ocean. The details of these explorations, surveys, road locations, etc., are given in Lieut. Warren's memoirs of the War Department, March 1, 1858, an epitome of which is published in Vol. I. of Capt. Wheeler's "Surveys West of the One Hundredth Meridian." The whole is a magnificent monument to the thorough training, ability, endurance, and devotion of the officers of the U. S. Army and their

companions in this most dangerous and difficult branch of their service.

RAILROADS.

It would have been impossible to have conducted the tremendous operations of such a war as that of the rebellion by means of the ordinary wagon roads existing at that time in this country. Railways, which had reached a state of very great development, especially in the North, in 1860, became therefore the true military roads, and require some brief mention in this connection. A reference to Gen. Cullum's biographical register of the graduates of the Military Academy shows that to these officers much of the credit for their location, operation, and management is justly due. He says:

"In 1827 the railroad mania began to rage in this country. At that time there were existing only a few insignificant local short roads, aggregating in length less than 20 miles, and there were few educated civil engineers in the United States to conduct larger works. Under these circumstances the Government adopted the wise policy of loaning officers of the army, scientifically educated at the Military Academy, to assist railroad companies in carrying out more ambitious projects. In this manner our army engineers became the pioneers in railroad construction and the educators of an able body of civil engineers, who to this day have continued the inherited traditions, methods, discipline, *esprit de corps*, and high bearing of their distinguished predecessors."*

The general geographical boundary that separated the hostile armies during the earlier stages of the conflict was that indicated by the Potomac, the Ohio, and the Missouri rivers. The main theatre of operations in the East, being the triangular portion of Virginia bounded by the Allegheny Mountains, the Potomac River, and Chesapeake Bay, was drained by a parallel system of rivers—the Rappahannock, Rapidan, Pamunkey, James, and Appomatox—each of which formed an admirable defensive line against an advance southward, for the river crossings were easily destroyed or obstructed. To supply the Army of the Potomac operating against Richmond, reliance could only be placed on the ordinary country roads, which were but fair in good weather, but almost impassable for army wagons and artillery in wet. With roads of such a character the lengths of haul must needs be short

* See Cullum's Biographical Register, Vol. I., p. 163.

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from the main supply depots, in order that the large armies might be supplied with provisions, forage, ammunition, and the multifarious other less necessary things so requisite for its success. The Confederates depended upon the uninterrupted service of their railway lines that drained the rich granaries of the South to fill their main supply depots, while the Union forces relied on water transportation for the same end. As illustrations of the great difficulties of supply by military roads, it may be well to quote the following statements of two great generals.

Speaking of the Virginia campaign of 1864, Gen. Grant says*:

"During the campaign of forty-three days, from the Rapidan to the James River, the army had to be supplied from an ever-shifting base by wagons, over narrow roads, through a densely wooded country, with a lack of wharves at each new base from which to conveniently discharge vessels. Too much credit cannot, therefore, be awarded to the quartermaster and commissary departments for the zeal and efficiency displayed by them. Under the general supervision of the chief quartermaster, Brig.-Gen. R. Ingalls, the trains were made to occupy all the available roads between the army and our water base, and but little difficulty was experienced in protecting them."

Gen. Sherman says†:

"To be strong, healthy, and capable of the largest measure of physical effort, the soldier needs about 3 pounds gross of food per day, and the horse or mule about 20 pounds. * * * Our base of supply in the campaign of 1864-65 was at Nashville, supplied by railways and the Cumberland River, thence by rail to Chattanooga, a 'secondary base,' and thence forward a single-track railroad. The stores came forward daily, but I endeavored to have on hand a full supply for twenty days in advance. These stores were habitually in the wagon trains, distributed to corps, divisions, and regiments, in charge of experienced quartermasters and commissaries, and became subject to the orders of the generals commanding these bodies. * * *

"An ordinary army wagon drawn by six mules may be counted on to carry 3000 pounds net, equal to the food of a full regiment for one day, but, by driving along beef-cattle, a commissary may safely count the contents of one wagon as sufficient for two days'

* Gen. Grant's Memoirs, Vol. II., p. 572.

† Gen. Sherman's Memoirs, Vol. II., p. 389.

food for a regiment of a thousand men; and as a corps should have food on hand for twenty days ready for detachment, it should have three hundred such wagons as a provision train; and for forage, ammunition, clothing, and other necessary stores, it was found necessary to have three hundred more wagons, or six hundred wagons in all for a *corps d'armée*. * * * The value of railways is also fully recognized in war, quite as much if not more so than in peace. The Atlanta campaign would simply have been impossible without the use of the railroads from Louisville to Nashville—185 miles,—from Nashville to Chattanooga—151 miles,—and from Chattanooga to Atlanta—137 miles. Every mile of this single track was so delicate that one man could in a minute have broken or moved a rail, but our trains usually carried along the tools and means to repair such a break. * * * Our trains from Nashville forward were operated under military rules, and ran about 10 miles an hour in gangs of four trains of ten cars each. Four such groups of trains daily made 160 cars, of 10 tons each, carrying 1600 tons, which exceeded the absolute necessity of the army and allowed for the accidents that were common and inevitable. But, as I have recorded, that single stem of railroad, 473 miles long, supplied an army of 100,000 men and 35,000 animals for the period of one hundred and ninety-six days, viz., from May 1 to November 12, 1864. To have delivered regularly that amount of food and forage by ordinary wagons would have required 36,800 wagons of six mules each, allowing each wagon to have hauled 2 tons 20 miles each day—a simple impossibility in such roads as then existed in that region of country. Therefore I reiterate that the Atlanta campaign was an impossibility without these railroads; and only then because we had the men and means to maintain and defend them, in addition to what were necessary to overcome the enemy."

It is thus evident that railways have become the true military roads of an army, and that their location in the future will have a determining influence on the plans of campaign to be adopted. When armies relied only on wagon roads there was comparative equality in celerity of movement with the successful and the defeated, whereas, hereafter, the greater advantage in this respect will be on the side of the retreating army, provided it can hold the line of railway in its rear. The history of the rebellion scarcely presents a single instance, in such a case, of a successful and, at the same time, of a rapid pursuit. Even in Sherman's Atlanta cam-

paign, with a greatly superior force, the advance was greatly delayed by the frequent necessity of repairs to the railway and bridges, and the urgency for immediate restoration to a working condition led to the organization of an efficient construction corps commanded by specially skilled engineers, of whom Col. W. W. Wright, in Sherman's army, and Col. Herman Haupt, in the Army of the Potomac, were illustrious examples.

CORDUROY ROADS.

The ordinary dirt roads over which the various armies moved during the rebellion were very soon cut up by the heavy traffic to which they were subjected, that even in good dry weather they were unfit for the purpose of travel by the army wagon; and in wet weather they became absolutely impassable. This was especially the case from the main depots of supply of an army to the several corps, divisions, brigades, or other subdivisions. Fortunately, in nearly all cases, the country was well wooded and furnished abundance of small timber to make a semi-permanent covering for the much-traveled roads. The usual method employed was to lay a sufficient number of stout sill-timbers lengthwise, and to place crosswise on these saplings of about 4 to 6 inches in diameter, which were tied down by side rails, secured by anchor pickets or other means. Many hundreds of miles of these roads were built during the war for the armies in cantonments, and often it even became necessary to do so for the single passage of an army in advance or retreat. A marked example of this is seen in the advance of Sherman's army over the low swampy grounds between Savannah and Columbia, in his onward movement toward Goldsboro, where for a time every foot of road had to be corduroyed. The American volunteer soldier displayed such an adaptability to his surroundings and such ingenuity that he soon acquired a marvellous aptitude for road and bridge building, so as to cause little delay in the army's progress, no matter what difficulties offered themselves to bar its advance.

MILITARY BRIDGES.

Prior to the Mexican War there was no organized bridge train in the United States service, but during that war two complete trains of india-rubber pontoons were constructed and sent to the army in the field. Subsequently these trains were sent to West Point for the instruction in pontoon bridge drill of cadets and engineer troops stationed there. In 1858 they became unserv-

iceable by the deterioration of the vulcanized rubber of which they were made, and in the fall of that year experiments were undertaken to fix upon a suitable bridge train for the exigencies of the army service. After two years' careful investigation the French wooden pontoon was adopted for the reserve-bridge train, and the Russian canvas pontoon for the advance-bridge train. Owing to the length of the reserve pontoon boat, the wagon required to transport it over the narrow and crooked roads of the country was designed on the principle of the four-horse truck, which, by means of a fifth wheel over the front axle and an inclined wagon-bed, permitted the forward wheels to reverse completely under the load and the wagon to turn in a very short space. As an adjunct to these bridge trains, for the bays nearest the shore, the Birago trestle was adopted to form part of the bridge equipage. During the winter of 1861-62 five reserve trains of thirty-four pontoons and eight trestles each were constructed, and several canvas trains were also organized, all of which were thoroughly tested in the War of the Rebellion. It was soon found, as the result of experience, that the trestles could be dispensed with in most cases, as the wooden pontoon was sufficiently stiff to be used in shallow depths, or even over marshes and swamps.

Of the numerous examples of the use of pontoon bridges in the rebellion, the following may be cited for illustration:

In the month of February, 1862, a pontoon bridge, composed of sixty boats of the reserve train, was thrown across the Potomac at Harper's Ferry. The river was then a perfect torrent, the water being 15 feet above the summer level and filled with driftwood and floating ice. The greatest difficulty was experienced in pulling the pontoons into position, and it was necessary to make use of ship anchors and chain cables to hold them in place. Notwithstanding these unfavorable circumstances the bridge was completed in about eight hours, and the corps of General Banks, with all its trains and artillery, passed over it without accident or delay.

Several of these trains accompanied the army in the peninsular campaign. The pontoons were used in discharging quartermaster and commissary stores at Ship Point; in disembarking General Franklin's command at West Point, and in constructing bridges over Hampton Creek, the streams in front of Yorktown, and the upper Chickahominy. Finally a bridge was built over

the lower Chickahominy about 2000 feet long, over which nearly the whole Army of the Potomac, with its immense trains, artillery, and cavalry, passed with promptness and safety.

"During the Fredericksburg campaign it became necessary to force the passage of the Rappahannock. The enemy having entrenched themselves on the bank, prevented for some time the construction of the bridge, until at length troops were embarked in the pontoons and ferried across, where they stormed the rifle-pits and held them until the bridge was completed.

"During the year 1863 the pontoon trains accompanied the army in all its marches backward and forward through Virginia, frequently bridging the Potomac, Rapidan, and Rappahannock. In the latter stream the bridges remained in position all winter; and, notwithstanding the frequent floods and quantity of ice formed, but few interruptions occurred upon these thoroughfares. During the campaign of 1864, trains composed of fourteen pontoons and two trestles accompanied each of the three army corps of the Army of the Potomac. These trains attended their corps in the long march from Culpeper to the James River, and, although the roads were frequently very bad, in no instance did they delay the march of the troops or arrive late when a bridge was to be laid. The headquarters train was followed by a canvas train, which, when a crossing was to be made by surprise, was sent forward with the cavalry, who covered the construction of the bridge and held the position till the main body arrived."*

In the campaign of 1864, the position of the Army of the James at Bermuda Hundred required much bridge building. The bridge equipage of this army comprised one new reserve train of fifty boats, twelve trestles, with wagons and harness complete; one advance-guard train of twenty-five boats, with wagons and harness; and twenty-five canvas and thirty-three surfboats belonging to the Tenth Corps of that army. On the 20th of June the James River was bridged at Deep Bottom, where its width was 575 feet. This was accomplished by silently launching the wooden pontoons a mile and a half above the designated location after dark, and ferrying 1400 troops across to the point previously selected on the enemy's side of the river to cover the pontonniers while constructing the bridge. The landing was effected in thirty

*See United States bridge equipage. Washington: Government Printing Office. 1870.

minutes, and by 11 o'clock the bridge head was defensible against attack.

Another successful passage of the James River occurred on September 29, by the Army of the James, which resulted in the capture of the outer line of the Richmond defenses. In this instance the engineer officer charged with the duty of constructing the bridge had several days' notice of the contemplated movement, so that he was able by personal reconnaissance to select the most suitable point of crossing. The bridge was constructed by successive pontoons at night in the strictest silence and secresy, and as it progressed was covered with long manure and hay to deaden all sounds of the necessary labor. The bridge, when completed, was 1320 feet in length, required six hours for its construction, and was in complete order for the passage of the assaulting column an hour before the time designated for its arrival.

The Appomatox River was bridged at Point of Rocks to connect the armies of the Potomac and James, which, owing to swampy approaches, required a length of 2625 feet in all; and at Broadway Landing, on August 3, for the passage of the Second Corps to cross Bermuda Hundred to fight the battle of Strawberry Plain on the left bank of the James; and at the same place a canvas bridge, 460 feet long, on August 19, which, not being under the enemy's fire, required only an hour and a quarter for its completion, the abutments having been previously prepared.

The wooden pontoons were found to meet all possible requirements for actual service, especially in the tidal rivers in the eastern theatre of the war, but the canvas pontoon had many defects when it was put to a severer use than that for which it was designed. Its buoyancy was less, and its canvas subject to rot from the manure covering and to leakage from many accidents. While it served its purpose admirably in the Western armies, it could not meet the demands of the heavier traffic in the East.

As an example of the remarkable availability of the wooden pontoon, the passage of the James River by Grant's army in June, 1864, is worth noting. It was highly important that Gen. Lee should be kept in ignorance of the probable movements of the Army of the Potomac after the battle of Cold Harbor, and of the point of crossing the James River. To Lieut. Michie, Corps of Engineers, U. S. Army, was intrusted the selection of the bridge site, with the understanding that but twenty-four hours'

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notice was all that could be given from the beginning of the preparation of the approaches till the arrival of the column for crossing. The site chosen was at Fort Powhatan, where the width of the river was 1992 feet, and so efficiently was the service performed that approaches on both sides, aggregating over 1000 feet in length, were corduroyed, and abutment piers on each side of 150 feet in length were built fifteen minutes before the specified time had elapsed. Had it not been for an inexcusable delay of twelve hours in the arrival of the boats, the troops might have marched, without halting, across the river straight on to Petersburg. The bridge, being over 2000 feet in length, was constructed over a tidal river of great depth, and of necessity the usual methods of anchorage could not be adopted, and the expedient of attaching the anchor lines to a line of schooners moored above and below the bridge was happily devised. Over this bridge the bulk of the troops, trains, artillery, and baggage of the Army of the Potomac was passed without accident or delay, beginning at midnight of June 14 and completed at midnight of the 16th.

The movable column of the army of the James in its flanking march to Appomatox was obliged to move with great celerity. For the repair of roads, bridges, etc., two companies of engineer troops under the command of a field officer marched in advance of the infantry, while the remainder of two battalions followed the leading infantry division. The pontoon train moved with the headquarters train, and in this instance consisted of fifteen canvas boats and four trestles, or in all 380 feet of bridging, requiring for transportation twenty-two pontoon wagons, eight forage wagons, one wagon for spare chests and one travelling forge. In this march of seven days 20 miles of road and twelve bridges were repaired and built. The weight drawn by the 8-mule teams over poor roads amounted to 3168 pounds, which, with the weight of the wagon, 1278 pounds, made an aggregate of 4446 pounds to be drawn by each team.

OTHER MILITARY BRIDGES.

The impassability of the ordinary American roads in wet weather often prevents the transportation of the movable bridge equipage, and therefore necessitates other devices for the crossing of streams and rivers. During the rebellion many instances occurred of these improvised bridges, for a full account of which a reference to the admirable volume of Col. Herman Haupt on

"Military Bridges" will give all the requisite information. Many of the constructions there described are embodied in the "Organization of the Bridge Equipage of the United States Army," adopted for the service in 1869 and published by the War Department in 1870. This system was the result of the studies and investigations of a board of officers, consisting of Gens. Duane and Abbot, and Col. Merrill, of the Engineer Corps, U. S. Army, each of whom had the advantage of a wide and varied experience in his profession during the War of the Rebellion.

THE NICARAGUA CANAL IN ITS MILITARY ASPECTS.*

By Lieut. WM. R. HAMILTON, 5th U. S. Artillery.

A SUBJECT of so general and broad a significance, as indicated by the above title, necessitates a division into various sub-heads, in order that intelligent study may be pursued, and sound conclusions drawn. The Nicaragua Canal being in an uncompleted state, with the likelihood of some years elapsing ere it can be opened to the commerce of the world, the first division that naturally strikes the investigator, would be classed under the two heads, viz.:

First.—The canal in its present condition.

Second.—The status of the canal when completed.

To describe the canal simply as it exists to-day, would be like the cadet demonstrating his proposition in geometry, without first giving the enunciation of what he proposed to prove. Therefore to thoroughly understand our subject, it becomes necessary to subdivide the first head into the following sub-heads; and taking each in turn, give it the necessary amount of study for a thorough comprehension of the whole, thus laying the groundwork on a solid foundation, upon which we can rear the finished structure under the second head.

(1.) Ship canals generally, and their advantages for purposes of transport and commerce, as compared with other methods.

(2.) Comparison of various water routes and ship canals with the Nicaraguan.

(3.) Comparison of the Suez Canal with the proposed Nicaraguan.

(4.) The Nicaragua Canal described.

(5.) The military aspects of the canal at the present time.

Ship canals generally, and their advantages for purposes of transport and commerce as compared with other methods.—From the beginning of the world to the present time, navigation has been the charm that has drawn man on to discovery and con-

* This essay received first honorable mention in the competition for the prize medal of 1893.

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quest, to research and invention, to profit and wealth, until in these days it is nearly impossible to find any nook or corner of the globe upon which he has not set the imprint of his ever moving foot or the seal of his ever restless hand. We are just now celebrating a series of triumphs and discoveries that four hundred years ago led to the finding of a new continent and new oceans, yet at that time the seas were boundless and trackless wastes of water and the vessels that traversed them but mere cockle-shells compared with the great steamers and ships of to-day. At the present time, not a foot of ocean surface and hardly a foot of its depths but are known to man, and still his cry is onward, progress, profit and wealth. There being no new worlds to conquer, no boundless wastes to traverse, his tireless energy is spending itself in shortening and improving the routes both on land and sea, that his immense vessels of to-day use. Cry it down as we may, the effect of this restless energy,—whatever its motive,—is the continued advancing civilization of the entire globe and all its peoples. And so long as means of communication between countries increase and their peoples are brought into close relations with each other, so long will civilization and all it implies,—invention, wealth, prosperity and strength,—advance and increase. Yet the gist of all this increase may be summed up in the one word,—transportation.

"Transportation has opened the storehouses and granaries of the world, and has so knit together the kinship of mankind that famine is allayed, disease abated, poverty relieved, employment furnished, knowledge disseminated, the savage tamed, the heathen civilized, and the race ennobled through its benign influences." (Prof. Haupt.)

The three great means of transport are the highway, the railway and the waterway. The first two are exclusively used on land, the last exclusively on water, and both employ for their complete work the auxiliary help of the telegraph, cable and telephone. In one sense the railway is but an improvement of the highway, and occupies a position midway between it and the waterway. It is dependent on both for the greater part of its existence. So thoroughly is this recognized, that in England one half of the interior waterways are owned and operated by the railroads, while in this country many are rotting away from disuse, because the roads owning them will not operate them, so great is the prejudice yet remaining that a canal is injurious to

the interests of the railway. The railway and highway can either exist without the other, but neither without the waterway, and history tells us that even the ancients brought the produce of interior countries overland by caravan and then transported it to far-away lands by the ships of the Phœnicians, or Carthagenians. To-day, were it not for the great steamers and sailing ships to carry produce and goods from port to port, the railroads would have but little to support them.

Since the value of any method of transportation increases with the bulk that can be carried and the decrease of cost, it requires but little reflection to understand the immense advantages possessed by water routes over those of the land. On land, whether by rail or highway, there is a great amount of frictional resistance to overcome, while every change of grade necessitates the expenditure of power for which there is no adequate return. On the water, there is but the resistance of the air and water to overcome, and water being level there are no grades to increase the cost. The land route must follow to a great extent the contour of the land, avoid mountains, deep cuts, etc., and every change of direction increases the cost, while by water,—a straight line between the two points is the shortest course that can be taken. Water covers five-eighths of the globe and produces nothing but fish and ice,—charges must necessarily be lower on water than land. Again, land cargoes require frequent trans-shipment, while by water a greater amount can be carried without breaking bulk. The capacity of the largest freight car is but a small item compared with the amount of tonnage a modern ship or even a modern canal boat carries, while facilities for loading ships are greater than for loading cars. Moreover the efficiency of the marine engine of freight steamers is to the freight locomotive as 7 to 1, making a great difference in the cost of operating. And while to increase by a small amount the capacity of a railroad, increases its cost by a ratio as great, the commercial value of a canal increases as the cube of its depth. In other words, a canal with a depth of six feet, would have its commercial value increased eight times by giving it a depth of twelve feet.

The water route on land costs but little to maintain,—that on the sea nothing at all,—while the maintenance of the highway or railway is often its greatest cost. The facilities for loading ships and the amount carried at one time being also greater, the water route may be said to possess an economy of time as well

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as cost over the railway, since the total amount carried in one ship equals that of a number of railroad trains. The difference in cost of the two systems of transportation is well illustrated by the following example. In the lake and canal system between Chicago and New York in 1868 the charges were 22.79 cents per ton as against 42.6 cents by rail; in 1878 they were 9.15 cents against 17.7 cents; in 1891, 5.96 and 15 cents respectively, thus proving that notwithstanding the great improvement that had taken place in railroads, and the many roads built between the two points named in that time, and the apparent neglect of canals, the latter were able to maintain their supremacy of economy and also to make handsome profits at the same time.

Another illustration: In 1891, before the Trans-Continental Association of Railroads in San Francisco, it was stated regarding the subject of freights between New York and San Francisco that "the American clipper ships are carrying freights from San Francisco to New York around Cape Horn for $3.50 per ton, while the railroads charged $20 a ton, and the ships are getting the most of the freight." Yet the route by water was 12,700 miles longer than the rail route. According to this statement, the rate per ton by water was about one-fifth of a mill per mile yet there was profit in it. In short it may be stated as an axiom that the cost of carriage by ocean vessels can be reduced to so low a point with profit that railroads can never hope to compete with them, while, in whatever way it is looked at, the advantage of water to land transportation is clearly shown.

In Great Britain in the year 1890, there were 2741 miles of interior waterways, of which 1238 were owned and operated by the railroads, while the remainder were independent. The relative expenses of rail and water freights were for that year 100 per cent. for the former and 32.3 per cent. for the latter,—a saving of 67.7 per cent. for the canals. That same year at the International Congress on Navigation, held in Manchester, it was stated by the advocates for water transportation:

(1.) That there is room for both canals and railroads between large centres of produce or manufactures, and the seaports of a country.

(2.) That cost both of construction and maintenance of canals being much less than that of railroads, there is much freight that can be transported at less cost over the former.

(3.) That where the canals and railroads run side by side, a

healthy competition is maintained to the advantage of the trader and without detriment to the railway,—the more economic transport by water so increasing the output of a district as to more than compensate the railroad for the loss of heavy traffic, by the additional passengers and goods.

(4.) The main advantage claimed for water carriage over that by rail is, that while equally efficient for all classes of freight, it is for some far more economical.

Facts and illustrations can be gleaned from records and statistics, sufficient to fill volumes, but it is believed that the foregoing are enough to show any unprejudiced mind the advantage of the ship-canal as a means of transport. This brings us to the second sub-head, viz.:

The comparison of various water routes and ship-canals with the Nicaraguan, thus illustrating more clearly the advantage,—both commercially and strategically,—of the Nicaragua route.

For many centuries canals have served a most useful purpose in connecting interiors with seas and rivers. The ancients at first used them for purposes of irrigation and water supply of their gardens and cities, but soon turned them into the means of transporting their vessels and the carrying on of trade. Ptolemy and Pharaoh both attempted to connect the Nile and Red Sea by a ship-canal, but the earliest authentic accounts of a successful canal, on a scale large enough to serve for carrying war galleys, is the so-called Corinthian Canal. Nero first caused plans to be made for cutting the Isthmus of Corinth by this channel, and uniting the Mediterranean and Adriatic seas, although as early as 625 B. C. the thing had been spoken of. Remnants of this old work still remain, showing extensive cuttings and large excavations. The stepson of Augustus,—Claudius Nero,—in the year 12 B. C., built the Fossa Drusiana, a canal connecting the lower Rhine with the Zuyder Zee, while in the eleventh century there existed many canals in Italy, and its commercial prosperity, as well also as that of the Low Countries and France, may be said to date from the building of these waterways then and in the following century.

But the ship-canal proper is only a creation of modern times, since in the early days the vessels were but pigmies compared to those of the present date.

Ship-canals may be divided into two general classes, viz.: (1.) The sea-level canal. (2.) The lock canal.

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A sea-level canal offering a most excellent illustration of commercial and military advantages of a shortened waterway is the North Sea–Baltic Canal, constructed under the auspices of the German Empire, across the Danish peninsula. Although a canal had existed here since the early part of the eighteenth century, it was not till the German navy had reached a point in its growth where it had become a very considerable factor in any European war, that the first active measures were taken by the Reichstag to build it. This was in 1886, and on June 3, 1887, the work was formally commenced by the Emperor in person. So rapidly has it been pushed forward that it is expected to complete it the latter part of 1894. It starts at Brunsbuttel at the mouth of the Elbe in deep water, passes through the marshy and low regions of the river, makes use of the Kudener Lake and the Burger moor, cuts the ridge near Gruenthal 80 feet in height, enters the valley of the Eider and empties into that river itself at Schulp, where a strong levee will be built to protect it from the river freshets. Its length is 61.3 miles, of which 63 per cent. is a straight line. The average depth is 29.5 feet and width at top 197 feet—at bottom, 86 feet. Its cost when completed will be about $40,000,000. A glance at the map will show the great saving of time and distance to ships running between the North and Baltic seas, while its commercial value is best understood from the following facts: Between 1858 and 1885 there ran ashore in the vicinity of Cape Skagen and neighboring islands 6316 vessels, of which 3133 were total losses. The loss of life was enormous, and all this would have been saved had the canal been built. From the great number of vessels annually passing Cape Skagen, it is estimated that from five to six millions tonnage will make use of the canal each year, thus insuring a toll of $1,000,000. Its military value to the German Empire is even greater than its commercial. Through the peculiar situation of the coast line, divided by the Danish peninsula into two parts widely separated, Germany's fleet in case of war would have two coasts to protect. Since the two most likely powers to war with Germany are France and Russia, this division of the coast is the more unfortunate since it would compel the maintenance of two fleets, which would have to do a great deal of manœuvring and work to be at all successful against either of the more powerful fleets of her adversaries. The canal changes all this. One end being in the strongly fortified harbor of Kiel and the other at the mouth of the Elbe, the canal itself

is safe, and in war Denmark would have to remain neutral. The advantage of the canal is then seen when we consider that a naval power attacking Germany, in either sea, can be quickly confronted by her entire fleet. In other words her whole naval force can be moved on an inside line against an enemy in either sea, thus practically doubling her strength.

The Amsterdam ship-canal is another excellent illustration. The natural approach to this city is through the Zuyder Zee, from the north and east. Early in the present century a small ship-canal, fifty-two miles long, connected the city with the sea, but so great was the commercial rivalry of Rotterdam and Antwerp that at a cost of $16,000,000 a new canal fifteen miles long and twenty-three feet deep was constructed, so that ocean steamers can lay up alongside the dock in the city and receive or discharge cargo.

In the last century Glasgow ranked among the second-rate cities of Great Britain. It was situated on the Clyde, a small stream that twelve miles below the city was fordable. It was deepened and broadened, so that ocean steamers of the largest size could steam into the heart of the city, and to this work is attributed the fact that Glasgow ranks to-day the *second* city in size in Great Britain.

As an example of the lock canal, the Manchester ship-canal is taken. It is believed to be the greatest engineering work under construction to-day in the United Kingdom, and is intended to give vessels access to the city of Manchester. It commences at Eastham, a small town near Liverpool, and runs 35½ miles to Manchester, with a minimum depth of 26 feet, and breadth of 120 feet at the bottom. All rail and highway crossings are at a minimum height of 75 feet above the canal. There are five sets of locks, with a total lift of 60.5 feet. Its entire cost is estimated at $48,000,000 and its completion expected in 1894.

A great work that is steadily going forward is the enlarging and deepening of the old Corinthian canal. In 1881 a Gen. Turr obtained a concession from the Greek Government, and work was commenced in 1882. The new canal is to be four miles long,—an almost straight line across the Isthmus of Corinth,—and with an average depth of 26 feet. Its cost is estimated at $6,000,000.

In Italy work has been commenced on a canal which will connect the Adriatic and Tyrrhenian seas. Its length is 125 miles, average width at top 270 feet, and depth 40 feet. It will thus be

navigable for the largest war-ships, and vastly increase Italy's defensive power.

One of the most ambitious projects of modern times is presented by France, whereby it is proposed to bring about a connection between the Mediterranean and Atlantic Ocean. Such a route would not only shorten the track for merchant vessels and thus be commercially profitable, but would enable France to establish a coöperation of her war-fleets in the two seas, independent of Gibraltar. Its length from Bordeaux to Narbonne will be 250 miles, depth 28 feet, and estimated cost $300,000,000. In Russia plans have been made looking towards connecting the Baltic with the White Sea, and the Black with the Caspian Sea.

Turning to our own country, we find several splendid examples of both lock and sea-level canals. As an example of the latter, probably no work ever constructed by this Government has proved so valuable as the Chesapeake and Delaware Canal, across the Maryland peninsula. In the latter part of the last century and early part of the present, when railroads were undreamed of, when the resources of the country were meagre and the population small and scattering,—even then our public-spirited ancestors saw the need of this canal and determined to build it. Work was commenced on it in 1804 and it was finished in 1825, at a cost of $3,000,000. It is but 14 miles long, but the ridges cut through were immense, and the work accomplished —under the circumstances—wonderful. Its depth is but 10 feet, but for over sixty years it has performed invaluable service, and it is only of late years, since ships have grown so large, that it has become obsolete. It is now proposed to deepen and widen it for the largest vessels and thus increase its sphere of usefulness. All other things being equal, the further inland a city is and can maintain its deep water connection, the better it is for it. This canal would therefore be invaluable to Baltimore. By a route of 14 miles, over 200 are saved to foreign and 350 to coastwise vessels. Col. Craighill, U. S. E. Corps, in an official report of this proposed canal, said: "It will be doubted by no one that a deep water connection of such a character would be of vast importance in the contingency of war with a maritime nation." Also, "For security of communication and defense, this route is superior to any other." The estimated cost of the improvement is $10,000,000.

The Sault Sainte Marie canal, or "Soo," as it is generally

termed, is a lock canal. But one mile in length, it nevertheless outranks any canal in the world in the amount of tonnage passing through it. Built originally in 1856 at a cost of $2,000,000, it was enlarged to its present size in 1883 at an additional cost of $2,000,000, and the immense lock constructed. The canal connects the navigable waters of the Sault Ste. Marie River with Lake Superior, and in 1892 over 10,000,000 tons of freight passed through it, although, on account of cold weather, it was opened but 254 days of the year.

Although there are many ship-canals projected in this country, it must be owned that Americans are not yet as fully alive as Europeans to their great advantages as commercial routes. Space and time will not permit reference to many other ship-canals which might be quoted, but it is believed that the foregoing examples, which have been cited as a basis of comparison in a general way with the subject, are sufficient to convince any one of their great importance, both commercially and strategically, over the ordinary land routes, when points are widely separated. From the foregoing examples, it may be laid down as a rule that the commercial value of a water route is dependent on its cost and length of distance saved, and its strategic value is dependent on the saving of time, distance and cost to the Government in the conveyance of material and personnel of war, thus increasing vastly the defensive as well as the offensive strength of the country.

This sub-head may, therefore, be concluded by stating that in the case of a canal constructed through the Nicaragua country, there is a saving of over 10,000 miles between ports on the two sides of our own country, and almost as great between those of foreign countries. The North Sea–Baltic is in length 27% of the distance saved, the Amsterdam is 42%, the Chesapeake and Delaware is 4%, while the Nicaragua is 2%.

As all the ship-canals described, though connecting large bodies of water, cannot be said to be shortened ocean routes, it becomes necessary to compare the one example of a canal built for the purpose of connecting oceans proper—the Suez Canal—and its results, with what it is expected will be the success of Nicaragua. This brings us to our third sub-head.

Comparison of the Suez Canal with the Nicaragua Canal.—Away back in the time of Rameses II. a canal was dug connecting the Red with the Mediterranean Sea. Napoleon I. in his

occupation of Egypt discovering remains of this old work, determined to reopen it, but his career in that country being ended by his recall to France, the project was abandoned. As well known, its great projector as it stands to day, was De Lesseps, the French engineer, who after a great amount of opposition, especially from Great Britain, which to-day owns and governs it, succeeded in ten years' work in connecting the two seas by a channel navigable for the largest vessels. To-day England is the largest patron and greatest beneficiary of the canal, though she contributed but little towards building it. In 1857 the Prime Minister of England stated publicly many reasons for opposing its construction. The entire press of the United Kingdom was hostile to it. The *Edinburgh Review* said "it was utterly impracticable, that the available resources of Egypt could not execute such a work in one hundred years, that the cost of maintenance would equal the original outlay, that vessels would have to be paid to induce them to enter it," etc. The *Quarterly Review* followed in the same strain, as did all other British journals.

Recently an English author, referring to the different feeling prevailing now, said: "No one at that time could have foreseen that in less than thirty years from that date the Suez Canal would have been an accomplished fact, and would have become, perhaps, the most successful industrial enterprise of modern times, and that our Indian and Australian possessions would have participated in its advantages to an enormous extent, that it would have revolutionized our shipping and transit trade." Another great military writer said of it, "It has so increased the strength of Great Britain as to enable her to hold her Indian empire, which otherwise would even now be lost to her." It is easy for the reader to understand the great strategical value of the canal to England, since by keeping it she holds the road to India that Napoleon had pronounced the vital one, and therefore necessary to her existence. It is no wonder that she seized Cyprus and Egypt, and with Malta and Gibraltar has made the Mediterranean a stronghold from which she cannot be ousted, but by means of which she controls the destinies of Greece and Turkey.

The canal was commenced in 1859 and completed in 1869. Its length is 99.9 miles, width 192 feet at top and 76 at bottom, with a depth of 26 feet of water at all times. Since its opening, its traffic has increased so tremendously that its enlargement has become necessary. In 1890 the number of vessels passing through it was

3389, with an average tonnage per vessel of 2033 tons. The average charge was $3976 per vessel, but is now $1.85 per ton. The capital of the company was $40,000,000 divided into 400,000 shares, of which England took but 176,000 at $1.13. They were sold first for 60*c*. but are quoted to-day at $550, and in 1890 a dividend of 30% was declared. The length of 100 miles saves a journey of 3750.

Captain Mahan in his splendid work, "Influence of Sea Power upon History," opens with these words: "The history of sea power is largely but by no means solely a narrative of contests between nations, of mutual rivalries, of violence frequently culminating in war. The profound influence of sea commerce upon the wealth and strength of countries, was clearly seen long before the true principles which govern its growth and prosperity were detected. To secure to one's own people a disproportionate share of such benefits, every effort was made to exclude others. The clash of interests, the angry feelings aroused by conflicting attempts thus to appropriate the larger share of commerce,—led to wars. On the other hand, wars arising from other causes have been greatly modified in their conduct and issue by the control of the sea."

The brief description given of ship-canals, serves to illustrate their value, and the avidity with which nations owning waterways, seek to improve them, in order to aggrandize national and individual wealth and property. No body of water has played such an important part in the world's history as the Mediterranean Sea, and the Suez Canal connecting it with the Red Sea is worth to England an empire, since by its control alone, does she hold her eastern possessions. To her subjects in India, Australia and China, as well as at home, it is worth many times its cost and maintenance.

The Nicaragua Canal described as it exists to-day.—The last two decades have witnessed in our country a most marvellous growth of the Pacific Coast States, and though railroads have multiplied till one can choose between six different routes in going east to west, or vice versa, still the actual cost of transportation of goods,—in other words, their commercial value,—is more than it is from England to China. The trade and growth of the South American States, and of the Asiatic powers, and the islands of the Pacific, are sought for by the nations of Europe as well as by ourselves, and the most strenuous efforts

are put forth by all commercial states to control every channel of trade thereto. Such control means national growth, prosperity and power. In America, the Caribbean Sea occupies precisely the same situation that the Mediterranean does in Europe. Each divides continents. And the same reasons that compelled the construction of the Suez Canal, will force the building of a water route between the Atlantic and Pacific oceans. The coast line of a country with numerous and deep harbors, such as the North Atlantic states possess, offers easy egress and ingress to the people beyond such frontier line, and the easier and more frequent the means of communication are, the greater is the tendency to trade and intercourse. With an Isthmian canal completed the Caribbean Sea becomes like the Mediterranean, a great highway for the world's commerce, along whose paths the ships of all countries will sail, thus bringing closer to our shores than ever before, the interests of other nations. It will be much harder then than now to keep clear of international complications, unless we have the power to enforce the laws we lay down and maintain what we possess.

The necessity of a canal being granted, it becomes a matter of choosing such a route as will fill the national wants and needs to the greatest extent. In thus choosing, the main considerations involved are: the time of construction, the cost of construction and maintenance, time of transit of vessels and distances saved, and the commercial and military advantages accruing to the country possessing the canal.

The idea of connecting the two oceans by a canal across the Isthmus of Panama is by no means one of modern times. To the early discoverers of America, its value was in giving them a short route to India, and in attempting to find this short route, America was brought to the knowledge of mankind. And to-day, it is this short route to India and China that is one of the principal factors governing the necessity for building the canal. In 1550 Antonio Galvao indicated practically the same route for a canal that is used by the Nicaragua company. From that time to the present there have been many plans and attempts to connect the two oceans by this or some other waterway across the Isthmus of Panama. Without going into details, and omitting reference to the early explorations, it may be stated that up to the year De Lesseps commenced work on the Panama canal, no less than nineteen different attempts have been made by either the United States,

France, Great Britain, the Netherlands and Spain, to carry out this great work. In every one, however, American interests have been carefully watched and kept uppermost. In 1872 President Grant appointed a commission consisting of General Humphreys, Chief of Engineers, U. S. Army; Captain Patterson, superintendent of the U. S. Coast Survey, and Admiral Ammen, U. S. Navy, to "examine into, make suggestions and report upon the subject of inter-oceanic canal communication." After a great deal of laborious investigation the commission reported that of all the many routes ever proposed, only eight were deemed worthy of any particular notice, the eight being as follows:

Tehuantepec.....	length..	.150 miles.....	Altitude....	755 feet.
Nicaragua..... ...	"	169 "	"	153 "
Panama...	"	41 "	"	295 "
San Blas.....	"	30 "	"	1145 "
Caledonia-Tuyra.....	"	87 "	"	1009 "
Atrato-Tuyra...	"	115 "	"	800 "
Atrato-Truando.....	"	125 "	"	950 "
Atrato-Napipi.....	"	180 "	"	778 "

The commission further reported, "That the route known as the Nicaragua route, beginning on the Atlantic side on or near Greytown, running by canal to the San Juan River, thence following its left bank to the San Carlos River, at which point navigation of the San Juan commences, and by aid of three short canals of aggregate length of 3.5 miles reaches Lake Nicaragua; from thence across the lake and through the valleys of the Rio del Medio and the Rio Grande to what is known as the port of Brito on the Pacific Coast, possesses both for the construction and maintenance of a canal greater advantages and offers fewer difficulties from engineering, commercial and economic points of view than any of the routes shown to be practicable by surveys sufficiently in detail to enable a judgment to be formed of their relative merits."

Of these eight routes, but three have ever been planned out in full and attempted to be carried out, the rest being relegated to one side as possessing no merits of sufficient consideration when compared with either of the three selected.

The first of the three is the Panama Canal, projected by the brilliant French engineer who so successfully carried to completion his plans for the Suez Canal. Even while building this latter he declared that the only proper way to connect the Atlantic and Pacific was by a sea-level canal similar to the Suez. So great was

the faith of men, especially Frenchmen, in his ideas, that millions upon millions were subscribed to his scheme, and work commenced upon it. After the expenditure of over three times the amount of treasure originally calculated, and the loss of thousands of lives, but one-fifth of the total work necessary was done, and it then became evident to all that the true nature of a canal in that location was not understood. The melancholy end of the Panama Canal scheme is known to all. The deep excavations, the huge blastings, the many ruined machines and the desolation now existing on the line of the canal, testify to the energy with which this work was commenced; but the saddest spectacle of all is the clouded ending of a great man's life, the plunging into woe and dishonor of worthy families and the loss of faith of a great nation in a scheme calculated to bring to its already rich engineering triumphs a crown more brilliant than all.

The second plan has ended as the first—in a failure. It is known as the Tehuantepec Ship-Canal, and its projector was Captain Eads, the brilliant engineer who succeeded in making a deep water-passage at the mouth of the Mississippi after so many of our government engineers had failed. His idea was to lay a number of tracks across the route chosen, and at each terminal run them down into the water. On these cars ran, which were so constructed that upon running in the water and under a vessel, they carried the latter and its cargo across the Tehuantepec isthmus and set it afloat on the other side. On a small scale such railroads have been in successful operation, as the Chignecto railroad in Nova Scotia and the Morris canal in New Jersey, but this undertaking was so immense and novel that notwithstanding his many friends in and out of Congress, Eads could not succeed in raising sufficient capital to warrant taking even the preliminary steps.

The third plan may be said to be the result of a process of elimination of all that has gone before. It is the only plan that has appealed to Americans and the only one upon which progress has been made with a sure prospect of completion. It is the Nicaragua route, first explored thoroughly in 1872–73 by Commander Lull and Chief Engineer Menocal, U. S. Navy. In 1876–77 Mr. Menocal again made other explorations and surveys of this route while in the employ of the Nicaraguan government. In 1880, a provisional inter-oceanic canal society, believing the Panama Canal impracticable, obtained a concession from Nicaragua

for the construction of the canal. Among the members of this society were Gens. Grant, McClellan and Beale, Admiral Ammen, Levi P. Morton, H. J. Jewett, and many other men of influence and power. In 1881 a bill was introduced in the U. S. Senate by Senator Miller, of California, pledging the aid of the United States in the construction of the canal. But at the same time two other bills were introduced by the friends of Commander Lull and Captain Eads, and in furthering their ends they naturally antagonized the Nicaraguan bill, so that it failed to come up at all until the latter part of 1883. It was then brought forward as unfinished business and of course failed to pass by reason of the necessary two-thirds vote. In the meantime, foreseeing something of this, the Provisional Society had been merged into a corporation known as the Maritime Canal Company of Nicaragua, and negotiations for capital were carried on outside of Congress. Although the Senate had failed to pass the bill, Mr. Blaine, then Secretary of State, and his successor, Mr. Frelinghuysen, both had been preparing the way for a more certain and positive interest on the part of the United States in the canal by means of a treaty between the United States and Nicaragua, which put the canal exclusively under the control of the former government. This treaty failed of ratification also by reason of the necessary two-thirds vote, but so many friends showed themselves to the canal scheme, while the treaty was in process of formation, that the Maritime Canal Company pushed the work of final survey and exploration to completion. Mr. Menocal was sent out in January, 1885, with a number of assistants, and applied himself in making surveys looking towards shortening the route and decreasing the estimates of cost of construction. He returned the following June, and submitted a very thorough and exhaustive report of the entire subject. In March, 1887, he was sent out again with authority to negotiate with Nicaragua. He obtained a very liberal concession, which was ratified by the Nicaraguan Senate in April, 1887. In accordance with this agreement a party of engineers under Mr. R. J. Peary went out in November following to make the final surveys and line out the first work. In December a bill was introduced in the U. S. Senate incorporating the Maritime Canal Company. It was passed without delay and a similar bill having been introduced in the House, it was merged into the former, and after numerous delays it was also passed in February, 1889. This bill required

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that no director or incorporator could be in the company unless he was also a stockholder, and the success of the enterprise became at once assured from the many eminent men who were on the board of directors.

The original association had also caused to be incorporated a construction company as a necessary adjunct to the canal company, and this latter at once entered into a contract for the construction of the work. Under the charter given by Congress, the reorganized canal company dispatched a construction party with engineers and supplies, which party arrived at San Juan del Norte (Greytown) on June 8 and work was immediately begun. From that time until the present summer the work has been steadily pushed forward, and though at present the company has stopped for want of funds in the present straitened financial condition of the country, there can be no doubt but it will soon go forward to a successful completion.

Such in brief is a history of this great work up to the present time, and like all great enterprises it has met from the outset with hindrances and disparagements sufficient to deter less determined men than those in charge of it. Its work and results will last for the life of mankind,—it will when finished revolutionize the trade and commerce of our country, it will bring great and lasting prosperity to our Pacific States, it will unite the North American continent in one binding association for mutual protection and good; who then can doubt its success?

A glance at the map will convince any one that though somewhat longer in transit than several of the others, this route is undoubtedly the easiest of construction. Commencing at Greytown on the Atlantic, it makes use of the San Juan River and Lake Nicaragua and the basins drained by them, and has its western terminus at Brito on the Pacific, a total distance of 170 miles. But of all this distance, only a little less than twenty-seven miles is actual canal in excavation, the rest being free navigation. The great secret which makes it possible to build and operate the canal, is found in Lake Nicaragua itself. This large body of fresh water is an inland sea, 120 miles long and 45 in width, with a depth running to 240 feet. Its level is 106 feet above the sea, and as it is fed by the waters of a great basin and surrounding mountains, it is in itself a great natural reservoir by means of which the canal can be fed, and also without danger of sudden overflows. The waters of the lake empty into the San Juan River and thence into the Atlantic.

The San Juan has been navigable for many years for nearly its entire length, and though the first surveys were based on following it throughout its length, later work has shown that thirty miles of crooked and winding shallows near its terminus may be cut off, by a canal running straight from Greytown across the lowlands in a westerly direction for ten miles, and then striking the river at a deep and navigable part of it. Through this lowland the canal is easy of construction, being simply a matter of excavating by dredgers a huge ditch. But when the river is reached a lock has to be built, and within three and a half miles, two more, so as to raise the course on the river to the same level—106 feet—that the lake has. Then comes the hardest part of work, hard simply because it will require a great deal of time and labor. It is to cut through the eastern divide of hills which, three miles from the third lock, are so high as to require a cut of 140 feet in depth for nearly three miles. The 106 feet level is then run on to where the canal line strikes the river again, at a point called Ochoa. Here a huge dam 56 feet high is to be built to keep the waters of the lake at the 106 feet level. This work as far as the lake, with the exception of the first ten miles, is made into an easy, deep and safe water channel by reason of its being a natural basin, which collects the waters of this region, and also by making use of the San Juan and tributaries. On reaching the lake the course is northwesterly and considerable dredging will be required to make a deep and clear channel. From the western point on the lake, the distance to Brito, the canal terminus on the Pacific, is 17.5 miles. It consists of an excavated channel 11.2 miles long, then using another basin for 5.5 miles till, within a mile of Brito, comes three more locks to lower the canal from the 106 feet level to the sea. Both at Greytown and Brito, harbors will have to be constructed. There formerly existed at Greytown a harbor sufficient for vessels drawing 20 feet of water, but this has so filled up by the shifting sands, that only small boats could make use of it. A huge breakwater, docks, and considerable dredging will clear this out, and once built will be practically easy to keep clear. At Brito also a breakwater will have to be constructed. The canal when finished will have throughout its length a depth of 28 feet; it will be 100 feet wide at bottom (least width) and 169.4 miles long from ocean to ocean, but of this distance will have but 26.8 miles of excavated canal. The time of transit will be 28 hours, and it is estimated that it will take

six years to complete the work. The original estimates of cost were $65,064,176, but revised estimates bring this up to $100,000,000. There are no unsolved problems about it. The chief engineer, Mr. Geo. W. Davis, says: "Engineers who have examined it and the practical builders who have gone over it, one and all say it is simply a plain work. If the canal had been proposed to be built of the ordinary dimensions it could have been done for a moderate sum, but the plan calls for the construction of a canal which will pass the largest ship afloat at any time."

As a résumé of what has been actually accomplished, the following is a summary:

1. The final surveys for location and construction are completed.

2. The examination of all strata by borings and drills where excavations are required is completed.

3. The harbor of Greytown has been so far restored that vessels of twelve feet draft have access.

4. Extensive wharves, store-houses, machine-shops, offices, hospitals, landing places, etc., have been erected.

5. A telegraph line has been completed so that communication is had between any part of the work and the New York office.

6. A railroad along the line of the canal has been completed for a distance of twelve miles.

7. Temporary camps along the entire line have been completed.

8. The largest dredging plant in the world under one management has been acquired and is in complete running order.

9. Over a mile of canal proper has been opened by this dredging plant.

10. The valuable and exclusive franchise of the San Juan River and Lake Navigation Company, has been acquired by purchase, together with all its steamers, tugs, offices, shops, etc.

As far as done, the work has received the unqualified approval of all who have examined it. English representatives of the Manchester Canal Company said they had never known a large work so thoroughly studied and mastered in every detail. So far, the work has been below the estimated cost. The Government of Nicaragua has formally acknowledged that the company has entirely complied with the terms of its contract, which required that the work of construction should not be considered as commenced

unless two millions of dollars were expended on it the first year.

What is the military status of the canal at the present time?—In the present condition of affairs, the Nicaragua Canal cannot be said to be of any commercial value to the country, but in its prospective completion there certainly is no other industrial enterprise on the face of the globe that gives promise of such large and immediate returns, and where there is so large a commerce in sight in the waters of our own and other American, as well as foreign countries. In looking at it in this light, it will when completed be of the greatest practical utility to the Government in increasing our military efficiency in time of war, as well as—being under proper surveillance—a most powerful factor in removing causes of war. It therefore behooves us to remember that although in an unfinished condition, it would, if we neglected a single opportunity, be quickly taken up by foreign governments, and we are therefore compelled to ask ourselves what steps we should take at present to hold it in case of war, and also what part it will play in its unfinished state.

We are all aware that in the present condition of our navy, and with our small army, and a National Guard that is fit only for home police purposes, it would be utterly hopeless to defend our sea-coast line effectively against attack by any first-class maritime power. With over 20,000 miles of sea-coast to protect, with our large and wealthy cities, with no sea-coast defenses at home and a navy that even when finished as planned at present, will rank but fifth among the navies of the world, with an army not large enough for our own internal troubles, it would be utterly useless to attempt to do more than protect our sea-coast cities. Nor would the canal in its present state be in any danger. Nicaragua would be a neutral, and her territory would remain inviolate, but were it not so, the value of the work so far could be of no advantage to any nation attacking us. Nicaragua could not be overrun without a force invading her boundaries, and the harbors of Greytown and Brito are not in a state that will admit vessels of war. So, looking at it from any point of view, it would seem to be entirely foreign to the question under discussion, to take any account of the part Nicaragua would play in case of war between the United States and any great power. The same state of affairs would exist as if the canal had never been planned or thought of:—it would be simply a question of the de-

fense of our country. This being the case we come to the second division of the subject, which, properly speaking, is the very pith of this essay.

THE MILITARY ASPECTS OF THE NICARAGUA CANAL WHEN COMPLETED.

As the canal when completed will be United States property, it may be considered as a frontier line of the United States, and not only is it necessary to take steps for its proper defense, but such a line will undoubtedly alter the strategical situation of the entire country. We may therefore divide this second head into:

1. The part the canal will play strategically considered in case of war.

2. The proper defense of the canal.

The part the canal will play, strategically considered, when finished.—A frontier line can play a strategical part as effectively in peace as in war. In fact, such lines are often established for the purpose of preventing war, as witness the aggrandizing of Germany in 1870–71 by the annexation of Alsace-Lorraine.

In a general sense, all great commercial lines are strategical lines, since, as stated before, it may be laid down as an axiom of commerce, that where the greatest facilities for commerce or transportation exist, there do we find the greatest development and growth in wealth, prosperity and power. Whether we consider only the present, or look into the past, the truth of this principle is fully borne out. The Nile determined the growth of Egypt, the Euphrates of Assyria, Babylonia and Chaldea. On the Mediterranean, Carthage and Rome reared their mighty heads, while a few centuries later, Genoa, and Venice on the Adriatic, in turn, became the mistresses of the commercial world. It is to this principle that Holland and the Low Countries owe their wealth, and Great Britain her empire on which the sun never sets.

In our own country and times, we see in the mighty cities of the great lakes, the beautiful metropolis at the mouth of the Hudson, the cities on both Atlantic and Pacific slopes, and the powerful and wealthy centres along the Mississippi, the Missouri and the Ohio—the fruits of the application of this principle of commerce. In 1832 we had a population of 13,000,000 people and but 23 miles of railroad. In 1893, with 180,000 miles of railroad and innumerable water-ways, we have a population of 70,000,000. Wherever the railroads and water-courses centre, and wherever the facili-

ties for trade and commerce are the greatest, there do we find the greatest prosperity. The entire country has reaped the advantage, and not only is the great increase and spread of population over the inland, but along the sea-coast the marvellous growth of cities, is all attributable to the great facilities afforded for transportation. Compare the condition of Canada, of the South American States and Mexico with that of the United States, and who so blind that he will not at once own to the blessings brought about by faithfully applying this principle in every direction in which it can benefit mankind?

In 1891 the European states made demand for gold to meet their many obligations—to the extent of over $71,800,000, and the ease with which the merchants of the United States met this is evidence of the profits accumulated by them in the great facilities afforded them for trade. Prior to 1870, California, Oregon and Washington were scarcely known except as far-off countries, where gold-fields were on the decline and ruffians of the worst description ruled the country. From 1870 to the present time, six lines of railroad and numerous steamship routes have been opened, and the result is that to-day California stands without exception as the fairest garden state in the world. In 1890 the wheat crop of the Pacific States was upward of 50,000,000 bushels, the wool crop 65,000,000 pounds, while California's fruit crop that year was 235,000,000 pounds and wine 4,500,000 gallons. The commerce of San Francisco alone amounted to over $250,000,000, and although the greater part of this was with the Atlantic States, still a large proportion of these products was marketed in Europe. And yet, the Pacific States can only be said to have but just begun their development. In the forests of Oregon, Washington and Alaska there exists in all its virgin wildness an indigenous source of wealth, the value of which it is almost impossible to estimate. It has taken over a quarter of a century to deplete the pine lands of Wisconsin and Michigan, yet the amount of timber originally there is but a small part of what exists to-day on the Pacific slope. In Washington alone it is estimated that there are 200,000,000 acres of forest land having 400,000,000,000 feet of merchantable timber. This timber is of the very valuable sort used in building both afloat and ashore. The Puget Sound country every year opens up some new and startling product, and the immense coal fields there are calculated to be sufficient to supply the entire Pacific trade for a century to come. The climate of California is

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so mild that the isothermal line of northern Virginia strikes 200 miles north of the northern line of Washington. The result is that the former gold country is fast being turned into the richest and largest vegetable and fruit garden on the globe.

And this wonderful region seems equally good for many other products. Whether they belong to the animal or vegetable kingdom, here they reach their maximum state of perfection. Here the largest wheat berry for making the bread of Europe's millions, the finest wool fibre for clothing, the oil of the olive and the wine of the grape, the many semi-tropical and temperate zone fruits and vegetables, the hops for bread and beer, the immense timbers of pine and hemlock for ships' spars and masts, and oak for their hulls, the red wood and white pine for the habitation of man, the fuel for his warmth and the fisheries for his consumption, all are found in quantities beyond the power of imagination to compass. Yet, these industries and pursuits are but in their infancy. What then must they be when facilities exist for the trade that will be developed when China and all Asia, South America and the Pacific islands are brought as close to them as are the Eastern States to-day?

The Nicaragua Canal completed, they will be brought closer, as it will then take but two weeks for fast steamers to run from New York to San Francisco, while the fast freight trains on the overland railroads require an average of three to make the trip. In the present condition of affairs, New York is 15,600 miles from San Francisco, as all vessels have to go round Cape Horn—and the canal will shorten the trip to 4900. What a saving in time and cost, and what a wonderful agency in developing the Pacific States. Can any one calculate even approximately what this canal will have done for San Francisco alone ten years after its completion?

But there are many other sides to present to this attractive enterprise. In South America the healthiest and most permanent of the Republics are those on the western coast. At present their trade is principally with Europe. The canal completed, a journey from New York to Valparaiso would be shorter by some three days than from London to the same port. The same condition would exist with reference to all ports on the west coast of South America, the Pacific islands and eastern Asia. The effect would be to develop enormously the commerce between all these countries and the United States. The canal would

shorten the route between Europe and the Pacific ports by from one to three thousand miles, and would therefore become a great water highway, pouring wealth into the pockets of the nation. Even grant that it had no effect in developing American commerce, the foreign trade passing through it would pour an annual revenue into the country many times its cost of maintenance.

But how does all this affect the United States in any strategical consideration? I answer, in five ways:

1. As wealth brings power and prosperity and increase of population, with this enormous increase on the Pacific Coast resulting from the building of the canal, there would necessarily come a dominating influence of such strength over all the Pacific and eastern Asiatic powers, and South American States, that its voice would be listened to with attention and caution whenever it spoke. With wealth and population, comes the means of enforcing laws and demands. If these means are not provided, then great wealth and especially the source of wealth presents to the cupidity of powerful nations a temptation that all the Christian sentiment in the world will not enable them to resist. And tempted, then comes war. But with proper means of offense and defense, then peace is assured. The canal must therefore be looked on in the light of a great conservator of peace, since it is taken for granted that a people that has always shown the possession of a spirit of self-reliance and assertiveness, will most assuredly keep what they build.

2. The canal being American property and American interests being involved in it to a far greater extent than those of any other state, it must be considered as part of the coast line of the United States. Situated as it is some distance from us, with a neutral power between it and our country proper, it nevertheless so shortens the time of passage from our eastern to western ports that in time of war its possession is of prime importance. Grant that powerful and wealthy as we may become, our navy will never rank higher than third in size and strength among the navies of the world, thus having those of Great Britain and France ahead of it. Both of these powers have possessions close to our shores. To attack us successfully an enemy's fleet must not only be able to defend such possessions, but must outnumber our own at every point. A country cannot denude its own shores of naval protection in time of war, as there are too many aspiring Paul Jones who would be only too glad of such opportunity

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to work havoc and destruction on his shores. It is not too much to say that Great Britain and France combined cannot find ships enough to blockade effectually all our Atlantic and Pacific seaports and both termini of the canal. And unless such a condition did exist, it is, with the canal in our possession, a matter of ourselves applying a superior force at any point we desire to break the blockade. A powerful fleet in the canal, with both termini effectively defended by fortifications, is in a state similar to an army between two adversaries who are separated by 12,000 miles of marching. How easy for the fleet to attack and beat in detail each adversary before the other can come to its aid. On this point Senator John T. Morgan, of Alabama, said in his speech before the Senate in 1889: "Our consent that England, or France, or Germany, should construct and control the canal, wherever it might be located, that would cut the Isthmus of Darien, would long since have secured this great work to the world; but we could never consent to that.

"The national power that controls the transit of ships across the Isthmus of Darien must necessarily be one of the greatest powers in the world in its influence on commerce and naval warfare.

"It is a simple and inadequate illustration of the military feature of the subject to say that it requires two fleets, separated by 12,000 miles of sailing distance, to blockade one fleet of equal power to either in Lake Nicaragua. But this doubling of the power of a fleet at anchor in Lake Nicaragua, over that of any other great maritime power that is moving across the Atlantic or the Pacific to attack our coasts, is but a small part of the strategic advantage of such a situation. As a *point d'appui*, a foothold from which to attack or defend, to threaten or protect all the coasts of this hemisphere and the islands and adjacent seas, it is more a point of commanding power in the Atlantic and Pacific oceans than Gibraltar is in the Mediterranean Sea."

In his message to Congress in March, 1880, President Hayes says on this point: "An inter-oceanic canal across the American isthmus will essentially change the geographical relations between the Atlantic and Pacific coasts of the United States and between the United States and the rest of the world. It will be the great ocean thoroughfare between the Atlantic and Pacific shores and virtually a part of the coast line of the United States. Our mere commercial interest in it is greater than that of all other countries,

while its relation to our power and our prosperity as a nation, to our means of defense, our unity, peace and safety are matters of paramount importance to the people of the United States."

President Arthur, in a message to Congress in 1884, says: "The political effect of the canal will be to unite closer the states now depending on railway corporations for all commercial and personal intercourse, and it will not only cheapen the cost of transportation, but will free individuals from the possibility of unjust discriminations. It will bring European grain markets within easy distance of the Pacific, and will give to manufacturers of the Atlantic seaboard economical access to the cities of China, thus breaking down the barrier which separates the principal manufacturing centres of the United States from the markets of the vast population of Asia, and placing the eastern States of the Union for all purposes of trade, midway between Europe and Asia."

The present coast line of the United States is about 20,000 miles in length, nearly equally divided between the Atlantic and Pacific. But to pass from one to the other our vessels must make a voyage of upwards of 12,000 miles, or half the distance around the globe. The canal reduces this two-thirds, and although separated by a friendly and neutral nation, yet so dominating would the American voice be, that in war it could be considered in no other light than as territory over which we would send men and material, if necessary. Especially would this be the case when the great inter-continental railroad is completed, principally through the means of American capital.

3. To be prepared for peace is the surest guarantee of war, is as true as its time-honored reverse. Yet, to be thoroughly prepared for war, can never be seen in a more favorable light than in the case of the canal. The canal once built and in our possession, well defended by forts and fleets, open to all nations for commercial purposes, and closed to all at war, who can doubt that so powerful a weapon would make possible for the first time the enforcement of the Monroe doctrine, which has been so far but a myth and plaything for politicians. The wonderful growth of our country, the enormous wealth and the large population, have convinced Americans that to preserve our heritage and protect ourselves from attack we must build up our navy and increase our fortifications. Controlling the canal, under terms of amity with the countries between it and us, the waters of Lake Nica-

ragua affording secure shelter for our largest ships of war, the nation that would attack us would hesitate a long time and be very sure of her strength ere rushing to what would be inevitable defeat. On the other hand, with the guarantee of a powerful nation that the canal is open for commercial purposes to all nations at peace with us, there would then be no disposition to commit any act which would lead to war and the closing of the canal.

Captain H. C. Taylor, of the navy, very strikingly says on this head: "It is the lake that gives to this route a political and international importance unique and significant. The nation that controls this canal under terms of amity with Nicaragua will here find rest and refreshment for its fleets. Here may the delays of warlike complications, so injurious in sea water to the iron-hulled frigates of our times, so fatal to their speed, be safely endured without loss of efficiency, the crews growing healthier, the ships more clean-limbed and speedier in this great fresh-water sea. Hence may issue squadrons in the height of vigor and discipline, striking rapid and effective blows in both oceans and returning to refit in this sheltered stronghold, and to draw from it nourishment and fresh strength for a renewal of hostilities. There cannot be imagined a more potent factor in deciding threatened difficulties or in securing an honorable peace with a powerful enemy than the presence in this healthy and capacious water fortress of a strong fleet, prepared at a telegraphic sign from the home government to issue fully equipped from either entrance for instant service in the Atlantic or Pacific. So vast would be the power of the nation that controlled this transit, and so strong the international jealousies thus created, that it may be considered fortunate that this enterprise should now be moving forward as a purely commercial project, independent of the aid of any government."

4. In the event of the canal not being built under American auspices, such is the great commercial importance and so vast are the benefits accruing to the nation that does possess it, that to gain its ownership is sure to tempt the cupidity of some of the great powers, and the only way to gain its control then will be through war. Nations are like individuals, and to live they must prosper, for declining they die. And so long as men have passions, so long will wars last, unless the power of a nation is so mighty and strong that it overawes all others. In this nineteenth century it is the hard, grasping, selfish and obstructive side of the question that a nation looks to for advancement, and so what-

ever will give it wealth and power is considered worthy of war. Looking at it from whatever side we will, the guardianship of the canal will ultimately devolve upon some power or powers that are strong enough to secure to all nations a just participation in its benefits. If this were not so, it would soon attract the efforts of powers to seize and appropriate its benefits, and such a condition would surely result in war. Judging from the importance of her commercial interests and from her actions in the past, it is almost certain that if the canal is not controlled by the United States, it will be by Great Britain. Can we afford to add the canal to her strategic positions at Halifax, Bermudas, Honduras, and Victoria? And the nation that controls the canal will also control its commerce and revenue.

To lose control of the canal would be suicidal policy. It is worth to us a dozen San Domingos, Honolulus, or Samoas. With the canal in our possession, no successful naval war can be urged against us in the Pacific, and millions now spending for coast defense and ships might better be given to the canal. Any one can see at a glance that had the canal been open to us in the late Chilian alarm, our offensive strength would have been so largely augmented that the country would not have been disturbed for a single minute regarding the speedy victorious end of a campaign in that country. And on the other hand, it could have scarcely more threatened our national life had the Confederacy been successful, than were some strong power like Great Britain to gain a footing in Nicaragua.

5. Strange though it seems and far apart as they appear, there is always a strong connection between the strategical and political considerations that influence a country for or against war, and sentiment. There has never existed a great war but sentiment guided it in many features, while some wars, as witness the crusades and in later times the church wars, have been entirely wars of sentiment. There is a sentiment as to national life and war, as there is in love. It is American destiny to command the route between the Atlantic and Pacific, and to omit doing so would be to fly in the face of destiny. It would be considered by the American people as an everlasting shame were any other government to control or have any preponderating voice in what is so clearly our own. Every commercial and strategic reason demands our control of the route, for it is national sentiment. The Americans pride themselves justly on

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having the strongest and best government in the world. The strongest because it secures to all its people the supreme blessings of liberty, and has the power to protect them in the enjoyment of it, while its preëminence is established by its not having power to wrong the weakest inhabitant of the Republic. And it is this people who are themselves the Government, that have the sentiment that will raise the grandest monument to their enterprise and greatness that has ever been erected, in conferring the inexpressible blessing of the canal on all mankind.

Nature of the treaties and agreements entered into between the United States and the countries bordering and near to the canal route.—The nature of the agreement between the countries having an interest in the canal, must necessarily have a powerful influence in any strategical consideration that might arise. A study of the treaties with Nicaragua and Costa Rica show that the following are the main features, considered in a political light, of these agreements:

(a) The canal termini and the waters of the canal are made entirely neutral, in case of war between other nations or between Nicaragua and any other nation; the transit of the canal is not to be interrupted, for the merchant vessels of any nation.

(b) On the other hand, in time of war, the canal is to be rigorously prohibited to the war vessels of such nations at war, or whose destination manifests their intentions to take part in hostilities. Furthermore the port termini cannot be made a rendezvous for hostile war-vessels nor will prizes be allowed there except to enter in cases of distress.

(c) No contraband of war of nations at war shall be carried by any vessel through the canal.

(d) Exclusive control of the canal, its railroad and telegraph lines, is given to the United States. The revenues to be divided in the proportion of one-third for Nicaragua and two-thirds for the United States.

(e) Free access to United States troops, war-vessels, and munitions of war is to be had at any and all times whatsoever.

The remaining articles relate to the financial and personal relations of the canal, and do not concern at all the political considerations.

The proper defense of the canal.—The building and ownership of so great an enterprise as the Nicaragua Canal by citizens of our country, backed up by the Government itself, implies a pos-

session of the canal by the United States that will not be given up so long as the Government lasts. A work so far from the source of all military strength of the country, cannot, in these days of sudden and quick wars, be put in a condition of effective defense after such war has broken out. It becomes necessary then to discuss this part of our subject under the two heads of:

1. Defense in peace. 2. Defense and offense in war.

The extreme advanced position of the Nicaragua Canal, considered as a frontier line, places it in a condition similar to that which threatens any important outpost of a large work. Common sense, therefore, would lead us to take such precautions for its defense as we would in the case of the outpost. Because of this advanced position it possesses advantages that are manifest, but also many disadvantages that must be well guarded against.

In defending any advanced line, it is laid down that we should look at:

A. The general conditions of the line, with references to its weak and strong points and its possible enemies.

B. Facilities for the establishment of supply bases and depots.

C. Climatic conditions of the line, and ability of neighboring country to sustain large forces.

D. Accommodations for both armies and fleets.

E. Character and amount of force to be maintained on the line in time of peace and war.

A. The general conditions of the canal route are understood from the description given in the first part of this paper. The weak points in case of attack are evidently the terminal harbors, the locks and dam. At Greytown the depth of water is to be increased to permit vessels drawing 30 feet to enter the inner harbor. A study of the map will show that a ship of war within the harbor could easily destroy the entrance to the canal by blocking it up or disabling its banks. Though the first lock is nearly eleven miles from the harbor, yet it is possible, though not probable, for it to be destroyed by an enemy's shells thrown at this distance. Moreover, if an enemy could effect an entrance to the harbor he could also land a force that in a few hours could destroy the town, wharves, store-houses, and by sending small boats up the canal and by land, destroy the lock. He could even in this case sail up the canal to the first lock with impunity. It

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therefore follows that steps should be taken to prevent his ever effecting an entrance to the harbor. But even outside the harbor his shells can destroy the jetties, and the shifting sands of the San Juan delta would in a few months fill up the harbor once this protection was gone. The jetty then must be protected also.

The harbor at Brito, though of a better character in some respects, in others leaves the canal more open to an enemy's fire than that at Greytown. On this side the first lock is but a little over a mile from the harbor and less than two miles from the open Pacific. The harbor being small, it will become necessary to take such means as will keep an enemy outside of even the possible range of shell on the first lock. But even with the harbors protected, from the character of the country it is possible for an enterprising enemy to land forces below both or either Greytown and Brito, and by quick and sudden attacks of small parties, to destroy or seriously damage the locks. It is thus seen that the locks themselves become great sources of weakness, and especially so, if we remember that our vessels in the lake are rendered absolutely helpless once they are damaged to any extent.

From what we know of Nicaragua and its people, also of Costa Rica, and from the provisions of the various treaties with these powers, we can rest assured that from them there would be nothing to fear. On the contrary, their best endeavors would be put forth towards preventing any trouble that might lead to their losing their greatest source of wealth. Whatever enemies we would have to contend with, it is certain that the people of Mexico and Central America would not be numbered amongst them. Furthermore, the extension of the Monroe doctrine and our apparent capability of enforcing it, brought about by the canal, would give us such a predominating influence in South American affairs that we need have no fear of enemies among those States. Especially will this be the case, when the ties of friendship and commerce will be strengthened and cemented by the Inter-Continental Railroad now projected.

B. With the exception of the lowlands near Greytown, the line of the canal is peculiarly well situated for the establishment of depots of supplies. On the lake itself would necessarily be the great repair-shops, dry-docks and works for the vessels of war; while the junction of lake and river, the highlands bordering the river and the great natural basins of it, form positions of such great strength that small forces could easily hold them and effec-

tually guard the line of canal. The terminal harbors, the junction of the canal railroad with the various roads of Nicaragua and with the Inter-Continental Railroad, would be the positions for supply depots, while the lake, the islands thereof and the basins of the canal reduce the supply problem to the simplest nature.

C. The reports of the various surveying expeditions, and of scientists at various times, all go to show that the climate of Nicaragua, with the exception of the low country in the eastern part, is particularly healthy and salubrious. The products are principally of the food producing nature and are easily grown in great abundance. The presence of bodies of troops and the many vessels continually passing through the canal would stimulate the productive powers of the country until they became more than sufficient for all calls made upon them. Were this not so, the Nicaragua railroad would be able to bring plentiful supplies from the countries north.

There is a short rainy season, and northern troops stationed on the lowlands would suffer if left there long, but this would be obviated by the frequent transfer at no expense along the canal, to the high and healthy plateaus surrounding the lake.

D. Lake Nicaragua is in itself sufficiently large to hold the entire United States navy, if necessary. When finished, the harbor of Greytown will be commodious, that of Brito small, but sufficient for all calls made on it. As troops to protect the harbor terminals and line of canal would be required, barracks and quarters would have to be erected at such places. All the transportation would be done in the naval and canal company's vessels.

E. From a study of the various harbors of the United States, recommended by the Fortification Board of 1886 to be fortified, there is none so similar to Greytown that a just conclusion can be drawn as to what its proper armament should be. Also the same with Brito. The plans of Key West and the Tortugas are the nearest, and their natural features are also the nearest to those of Greytown. That strong forts should be erected, and of the turret style is evident. A study of the map would suggest that two strong turrets mounting the heaviest ordnance should be placed outside the harbor, and as far out at least as the extremity of the jetty. The sand-spits in front of the harbor should be lined with heavy batteries, which should run south-

ward as far as Harbor Head to cover any advance by light draught but heavily armed gunboats that might attempt a passage up one of the various mouths of the San Juan. Floating batteries and torpedo fleets with submarine mines would complete the armament and fortification of both inner and outer harbors. These in turn would have to be protected by earthworks.

On the other side, at Brito, the very heaviest guns should be placed in protected batteries on the shore and headlands on both sides the harbor, and still others at a sufficient distance south to prevent any vessel taking position there and shelling the nearest lock. The natural features of the high lands on this coast would render the positions of such batteries almost impregnable, certainly so against naval fire alone. Floating batteries, torpedo fleets and submarine mines guarded in turn by shore batteries, would complete the defense of this harbor. The proper positions of troops would naturally be at the various batteries and forts, and in strong positions also fortified, taken up in the vicinity of each lock and dam of the canal. Also of junction of lake and river. The main force would be on the lake, and by frequent transfers the troops could be kept in a healthy condition at all times. The accompanying table founded on calculations and data similar to those used by the Fortification Boad, is the estimate of the guns and armament and number of troops necessary in time of peace. As the distance from the United States is so great, this strength is calculated on a basis of one-third what would be necessary in time of war, which, with the naval vessels present, would be sufficient to hold the canal against any attack until reinforcements could arrive.

ESTIMATE OF FORTIFICATIONS, ARMAMENT AND MEN REQUIRED IN PEACE TIME TO GUARD THE NICARAGUA CANAL.

Greytown.—Two turret forts, mounting four 16″ guns, B. L. R.

Three protected batteries, mounting six 12″ guns, four 10″, six 8″—all B. L. R. Also thirty-two B. L. R. mortars, 12″.

Shore batteries for protection of submarine mines, torpedoes, etc., mounting altogether twenty-eight R. F. guns.

Brito.—Three protected batteries mounting four 16″, six 12″, four 10″, B. L. R. guns, and thirty-two 12″ B. L. R. mortars.

Two shore batteries for protection of mines, etc., with fourteen rapid fire guns.

At Brito a torpedo fleet of six boats, and at Greytown a fleet of eight boats will be necessary.

The points at which troops should be stationed in time of war, besides the harbor forts, will be at each lock, the dam and at several other points of strategic importance. Calculating on a basis of the number of men to man all guns in time of war and to guard the fortifications, with three reliefs for each gun, also men for operating mines and shore batteries, and then taking one-third of this total as the number necessary in time of peace as the proper protection, we have the following number of men :

In time of war, 10,600 men. In time of peace, 3500 men. The above does not take into account the management of torpedo boats, which, with the fleets and floating batteries, two of which should be at Greytown and one at Brito, are all left to the charge of the navy, and should be provided for by them.

At all times a powerful fleet should be kept in the canal. While the main rendezvous of the fleet would be the lake, vessels should constantly patrol the basins. The harbor fleets in time of peace would be the ships of the squadrons cruising in the adjacent seas. On account of the vulnerability of the canal at Brito, the Pacific fleet should be somewhat larger than the Atlantic, so as to have at all times one or two vessels in the harbor. By such means the harbors, locks and dam, and, in fact, the entire route of the canal, would be rendered entirely safe against any sudden attack. It is believed from a study of the problem presented that a less force could not be kept here without danger of losing by surprise. And though this force may seem large when compared with the small force known as the United States Army, we must remember that the situation is entirely different. The U. S. Army is entirely inadequate for the proper defense of the country, and even with the help of the National Guard, we would speedily find it so in case of outbreak of hostilities. We place a great deal of reliance on the National Guard, but the personal experience of every unprejudiced officer who has served with it, goes to prove that such reliance would be similar to that on the bruised reed. If the canal is taken from us in war, it will not be regained without most terrific fighting, while the United States, by reason of their geographical situation, strength and natural resources, could never lose in war more than her sea-coast cities.

2. *Defense and offense in time of war.*—It is reasonable to suppose that no war could occur after the completion of the

canal with any South American or Asiatic power, or with any inferior European state. But as it is often the unexpected that happens, we should consider what we would do if we were at war with either Chili, Brazil, China or Japan. The rest of the states of Asia and South America are left out as too inferior to be thought of. A war with any of them would be entirely a naval one, but the four states just named have navies of a size sufficient to do considerable damage, if not taken care of. In the case of China and Japan, their distance from the canal would render it impossible, unless in the far off future their navies should surpass our own, that they would even think of sending a vessel away from their own coasts. They would have more than enough to do properly to take care of themselves.

In the case of Chili and Brazil, though their navies are inferior to our own, there is a still more potent reason why the canal is safe from their attack. A glance at the table shows us that the distances of San Francisco, New York and New Orleans from Brito and Greytown, respectively, are 2700, 2660 and 1300 miles, while the distances of Valparaiso and Rio Janeiro from the same ports are 2807 and 2912 miles each. Under any circumstances the force indicated as proper to hold the canal could do so till reinforcements could be sent. It would require a little over two days from New Orleans and five days from San Francisco. There could then, it seems, be no possible danger to apprehend from these powers. This narrows the question down to those European states whose navies are superior to our own, or who by any possible combination could form alliances against us, and by combined navies bring a superior force against our shores.

A study of European navies and our own will show that when all the vessels building and contemplated shall be finished, our navy will rank in size and power immediately after those of England, France, and Italy. It is not within the bounds of possibility that Russia, Germany or Spain will then attack us with any probability of success. The first is our traditional friend and has no policy that in any way interferes with any of ours; the second is much too wise to enter into a war that, so far away from her source of power, would inevitably lead to disastrous results; while the third has too much to lose in her West Indian possessions which in case of war would surely be taken from her and kept. For similar reasons to those influencing Germany, Italy may be thrown out of the question, and the entire problem

then can be solved by discussing the probability of a war of England and France combined against the United States. It is reasonable to suppose that in a war of either or both of these powers with us, the contest would be almost entirely a naval one. A country which requires over three months to send only 10,000 men to Egypt to fight a half-civilized race, could hardly within any bounds of probability be able to raise an army of 50,000 men for the invasion of this country; and still less within the bounds of probability would it be for her to follow it up within a short time by a hundred thousand more. Yet any less force thrown on our shores would be suicidal policy. Her neighbor would hardly dare under any circumstances to send the same number of troops, thus taking away from her frontiers a force, every man of whom is needed to prevent hostilities from a traditional enemy. It therefore being a naval war, the following maxims, taken from a prize essay of the Naval Institute, are quoted:

1. A fleet protecting its own waters must act on the offensive-defensive.

2. A divided fleet, unless largely superior to any force which the enemy can bring into the field, loses its offensive power.

3. A beaten fleet, driven into a harbor, is practically useless, unless the enemy's subsequent operations be very unwise.

4. A modern fleet must have either a depot for coal or a line of supply, for a coal famine will compel a hurried abandonment of any position however strong.

5. A line of supply increases a fleet's danger in proportion to the increased length of such line.

By a study of the map, we see that the commercial routes towards the Nicaragua Canal are from New Orleans and the mouth of the Mississippi down through the Gulf and the Yucatan passage; from the eastern ports of the United States through the Florida straits and Yucatan passage; from European ports through the Windward and Mona passages. We also notice that the Gulf and Caribbean Sea are closed on the east and south by the Florida peninsula, Florida reefs and keys, Tortugas, Cuba, Jamaica, Hayti, Guadaloupe and Martinique. The Yucatan passage is formed by the jutting out towards the Antilles of the Yucatan peninsula. Cuba and Yucatan belong to Spain and Mexico respectively, and under all circumstances would be neutral. Jamaica belongs to England and she has at its capital, Kingston, a fortified naval station and base of supplies. Guada-

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loupe and Martinique are French possessions and would give to France a coaling and supply base. The island of Hayti is independent at present and might be supposed to be neutral in case of war,—if she could remain so,—but knowing that our enemies would not respect such neutrality, we would be justified in seizing such portion of it as would furnish us with requisite bases also. This would give to our enemy the Windward and Mona passages, by means of which he could easily threaten and destroy all our commerce passing down the Gulf and the canal itself. The Fortification Board of 1886 recommended most strongly the fortifying of New Orleans and the mouth of the Mississippi, Pensacola, Mobile, Tampa, Key West and Tortugas. This done would render the upper part of the Gulf safe, and if the Yucatan passage could be held and the Caribbean Sea, the canal and all our commerce to it would also be safe. The distance of New Orleans from the eastern entrance of the canal being but two and a half days' journey, and of San Francisco but five days from Brito, it is seen that under any circumstances it would be an easy matter for us to reinforce the troops on the line of the canal and the ships in it. So that can reasonably be considered safe. It then becomes a question of naval supremacy in the Gulf and Caribbean Sea. It is conceded that troops alone could not defend Greytown or Brito successfully against such a magnificent fleet as our combined enemies would bring against us. But they could prevent the capture of the harbors and prevent any landing parties from working towards the locks or dam. They could not prevent the partial destruction of the canal at the terminals, or of wharves, jetties, storehouses, etc. It is, therefore, necessary to have our fleets in both Atlantic and Pacific strongly increased. Here then is seen the principal reason why we should at all times have a strong fleet of war-ships in the canal or lake ready to sally forth from either entrance to reinforce our fleets there and make a superior force to the enemy's at such point. But since both England and France have strong naval bases close at hand, the problem becomes simply a matter of our maintaining in the Gulf and Caribbean Sea a naval force sufficient to guard the Florida straits and the Yucatan passage, and to prevent the enemy's coming in force through the Windward and Mona passages. Simple as this statement is, the execution of it is a different matter, for to do such a work would require our whole naval force, or what will then constitute our entire navy. This would

leave our Atlantic and Pacific cities bare of naval protection. To increase our navy to a size sufficient to meet such an emergency, and thus fulfil the naval maxims quoted as necessary to insure success, is against the policy of our country and would never be done except as a matter of self-preservation. We must then solve the problem in some other way. Is there any other solution? We think there is, and that, startling as it may seem, we must all sooner or later come to view it as the quickest, safest and easiest, as well as surest way.

If our enemy can be deprived of coaling depots and supply bases which are situated close to our shores, and his base of supplies therefore be made so much longer, he must necessarily be put on the defense. And half the victory in naval war is in taking the offense. But the only way to accomplish such an end, will be either to purchase in time of peace his possessions in our seas, or to capture them in time of war. It is well known that England never lets go what she once puts her iron grasp on, and for political reasons France would never part with her West Indian islands. All these islands so near us therefore would have to be taken by force of arms. That such a feat could be done, no true American will for a moment doubt, but that the loss of so many lives and the expenditure of the vast treasure requisite, would be worth the end,—is a matter that we believe Americans would wait till too late ere attempting. But there are other strategic points that can be obtained by purchase, and once in possession of them the position of England and France in the West Indies becomes untenable in war.

Notwithstanding her pretensions to the contrary, Spain would be willing to part with Cuba. A country whose treasury is impoverished, whose subjects in this far off island are continually revolting and causing the expenditure of vast sums to the mother country for which there is no return, would be very glad to part with it for a good round sum, such as we could easily afford to give when we consider the great worth to us of this Island of Cuba. Hayti also, would require but little persuasion to enter as a sister member of the great Republic. And once these two islands are in our possession, we command the southern seas. If we postpone till time of war the negotiations for such possession, we will fail to obtain them by peaceful means, and our only recourse then will be by force of arms. A country that is willing to drain the national treasury for the purpose of paying pensions

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to the survivors of the Rebellion, will pay gladly the amount of one year's payment of such pensions to insure to us an everlasting peace and possession of this western hemisphere. It would be cheap to purchase in open market at a price twice or thrice their commercial value to us, and we can afford better than any earthly power to bid high for these countries. In the end it is a saving of the national treasury. Once these islands are ours, England and France are both placed on the defensive to retain their possessions, well knowing that in time of war they must inevitably lose them. The result would be that under no circumstances would these countries declare war against us. In this way and this way only, can we be sure of a lasting peace and continued prosperity to our people. If we offer no vulnerable point to any possible enemies, if we guard strongly all we possess, then will our voice be listened to with attention, and any position we may choose to take in matters relating to the western hemisphere, will be carefully considered. Not only that, but believing in the ultimate destiny of our government and institutions and people, who can doubt but their beneficent effects will be extended over entire America. And to the entire world will we bring a broadened and enlightened civilization by the realization of that possible millenium when war will be no more, because we, being too powerful for any nation or combination of nations to attack, will have the deciding voice of the judge in all political matters of the entire western continent.

In conclusion it is understood that the present state of finances of the country has temporarily suspended work on the canal, but that such suspension is but temporary. All who know the magnitude of the work, so far reaching in its results, know that sooner or later the Government of the United States must come to the aid of the company and thus by taking official action and helping by aid of national finances to its completion, make an everlasting crown in the long list of great engineering enterprises of the country. In this paper, many of the views and thoughts given, though not original with the author, are nevertheless unknown to the mass of the people, and once there is a general understanding of the situation there must come an overwhelming national sentiment, that will convince our legislators that unless the aid is given, they will be condemned to a lasting oblivion by a people always patriotic and willing to spend any amount of life and treasure, when necessary, but not one cent or one life, for whatever is un-

national or un-American. Once completed, the great tide of commerce sweeping through it will bring us closer to all the states of South and North America, while the nations of Europe will sweep our shores continually with the swash of their vessels. The conviction that we shall be able to keep the fruits of our work, only by such means as I have indicated, will then come to all who have studied the subject in all its bearings.

In ending this paper, the author wishes to disclaim any right to originality of most of the ideas put forth herein. They have all been expressed perhaps better, by others. He cannot, therefore, claim as original anything beyond the manner and order of presentation.

In his investigations, he has been led to believe that after all there are times when even Washington himself would advise us to seize by taking to ourselves what naturally belongs to us. The possession of the entire North America under such institutions must be a blessing not only to ourselves, but to the entire human race. But when in addition, we feel that without them our own life is in danger,—our national life,—there can be no weak or hesitating voice, but with national unanimity, we will march on to victory whether by battle or the peaceful arts of policy. The difference to us comes afterwards; and it is to avoid the aftermath that we should take the means so clearly open to us, while the light lasts and our way is clear.

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PORTABLE INTRENCHING TOOLS FOR INFANTRY.*

By Lieut. W. C. WREN, 17th U. S. Infantry.

THE accuracy of modern fire-arms, their increased rapidity of fire and their great penetration, render necessary some shelter for the troops engaged on the field of battle. Natural cover may exist, and when such is found advantage should be taken of it, but usually artificial shelter must be constructed by the troops engaged in the action.

Intrenchments on the field of battle depend, as to their position, extent, and use, on the ground and on the tactical advantages to be gained; and, in conformity with this idea, they are constructed at the commencement of the battle or even during its continuance. Thus it stands to reason that when the necessity becomes apparent, the intrenchments must proceed with the least possible delay; and, that this may be practicable, the tools must be at hand and not in the wagons of the train. This was shown during the first part of the war between Turkey and Russia. In the various assaults on the works that surrounded Plevna, the men were driven to the utmost extremities for the want of proper intrenching tools. They were compelled to use their bayonets, mess tins, hands, and knives; sometimes filling up the open spaces with the dead bodies of their own men. Portable tools at such a time would have been of the greatest importance and in the highest degree beneficial, and would have materially aided the attacking party.

During the late war in this country we found the same wants in regard to intrenching tools, the men resorting to tin plates, halves of canteens, and knives, in the same manner as the Russians, in order to protect themselves against the greatly inferior shooting weapon of that day. During the latter part of this same war field intrenchments received their fullest development, and a line rarely went to the front without taking such materials

Note.—In the German service, normal shelter pits are considered safe against small-arm projectiles and shrapnel fragments only when there is an earth defense in front of 60 inches.

* Read before the Fort Leavenworth Branch, Military Service Institution.

as could be rapidly and easily gathered, for the purpose of forming the nucleus of a breastwork. The Atlanta campaign furnished many cases of this kind of fighting, and General Sherman says that even his skirmishers were accustomed to carry forward logs, rails, etc., to help intrench.

This lesson has been learned by all foreign nations; but we, the originators of the system in modern war, have completely neglected it. To-day it is generally accepted as a fact that the troops that take a position from the enemy must fortify it, or at least be able to do so; circumstances may be such that the Engineers can be pushed up and employed in this work, but more often they will not be on hand; and as infantry forms the bulk of an army, it is to it that the work of assaulting falls, and it is the arm that has to render secure the position when taken.

The preparation of a position for defense, when time and tools are available, is ordinarily made by the engineers accompanying the army. Their duties more especially belong to the class of works that have some permanent value, and not to those that have the nature of rifle-pits and shelter trenches. To them falls the duty of repairing and destroying roads, building and destroying bridges, etc., and from the nature of their service considerable transportation in the shape of wagons is necessary. These wagons are only too often far behind; or, if in front, they are in positions from which they cannot move in safety to themselves or advantage to the other arms. At Gravelotte the right of the French line, about St. Privât, was susceptible of intrenchment and could have been strengthened enough to have made the German success at that point problematical if not impossible. This was recognized at the time, but there were no tools in the hands of the troops, and all efforts to supply the deficiency by bringing up the engineer tool wagons were rendered abortive by the fact that the train itself was inextricably mixed up in the rear of the line, and they could not possibly be brought up to the point where they were so much needed. On the other hand, the Germans, recognizing the value of earthworks, proceeded to strengthen their position as soon as it was captured.

It is, then, necessary to provide other means by which, when positions are taken, they can, without delay, be placed in a state of defense; time may not allow, or circumstances may prevent, the bringing up of the tools of the pioneer or engineer corps, as in the instance quoted above; therefore, the work must be done

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by the troops already in the position and they must possess the tools with which to do it.

The few minutes following the taking of a position by assault are invaluable, as at this time a comparatively small amount of work may make the position so strong as to deny it to the enemy for the rest of the battle, while a neglect to so strengthen it may (and generally will) result in the unnecessary loss attendant on the taking of a position that cannot be held. Abundant time may be available, but even in villages or towns tools are not always to be found, and certainly they will not be on hand in woods or open fields. It therefore becomes a necessity to provide the needful tools and means of carrying them. First, we should decide on the tools to be used in the different cases that may arise; there are only three general cases:

1st. Woods.

2d. Open ground.

3d. Villages or towns.

These may occur singly, but, in the general case, two and usually three will enter every field of battle.

The tools for felling trees and cutting brush are axes, bill-hooks, and saws; for open ground, spades and picks; for villages, all of these, and in addition, crowbars and some means of demolishing walls and houses—such as gun-cotton or dynamite.

Now it is manifestly clear that an infantryman cannot carry all of these tools, and, upon examination, it will be found that any one of the common form is of such weight that, even neglecting their size, it would be impossible to carry them in the field in addition to the other necessary burdens. We must, therefore, make the absolutely indispensable tools of such weight as will allow of their being easily carried by the soldier, while at the same time, they must be strong enough to do the work required of them.

It must be understood that while these tools are not primarily intended for use in throwing up permanent works, it is possible to use them in this way if necessary; as most of the works thrown up by the Roumanian troops before Plevna in the Turko-Russian War were made with the Linnemann shovel, and thus in part they may take the place of the engineer tools. Their proper work, and the one for which they are intended, is the making of shelter in the open where none exists, or of improving such as already is present. Mayne says "If cover cannot be obtained that will give complete protection from fire, the next best thing

is cover from sight, because anything which can prevent an enemy from taking a definite aim must reduce the efficacy of his fire, so that, at all events at the commencement of a fight, any kind of cover should be sought and be made use of."

Tools must be carried by advance guards, outposts, and detached parties; for they must often hold their ground at all risks, and if they wait to be supplied from the rear the position may be lost for want of implements to make the necessary cover.

Argument as to the *necessity* of intrenching tools seems almost out of place now, as almost all nations have acknowledged their necessity as fighting implements second only to the rifle; but in our army we have not as yet adopted one. The hunting knife is a substitute much in the shape of the half loaf, *i. e.*, it is better than none; but the intrenching tool proper is practically unknown to our soldiers. I have accordingly thought it proper to give drawings of as many tools as I could procure, with some discussion as to their merits and demerits, with a view to opening the question of the selection, not of a particular tool, but of some type for use.

The chief requisites of this type of tool are, first, that it shall be a good digging implement; second, that it can be used as a cutting tool for small brush, etc., for the purpose of making fascines, etc.; and third, that in fulfilling these conditions, neither shall compromise the other.

The United States Ordnance Hunting Knife and Intrenching Tool is issued to the men in the U. S. Army for use as an intrenching tool and also as a hunting knife. Its dimensions are as follows:

Length, about $13\frac{1}{2}''$.
Length of blade, about $8.1''$.
Width of blade, about $2''$.

The handle is of wood, $4.5''$ long, and turned so as to give a grip for the hand; the blade has a rib running the whole length, and is sharpened on one side to give a cutting edge, the other side being heavy and about $.25''$ thick. The lifting surface is about 14 square inches. The carrying case is made of very heavy leather, bound with brass, and is attached to the belt by means of a brass hook fastened to the upper part of the scabbard by three rivets; the hook tapers to a width of about $.25''$ so as to allow of its being passed through the thimble of the field belt.

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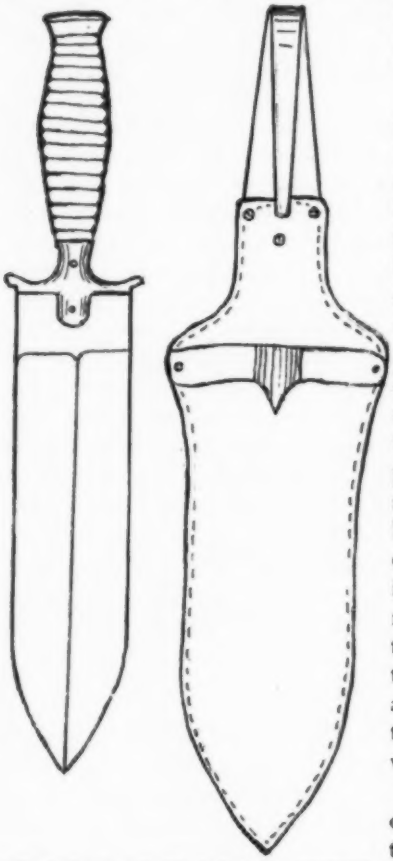
Its weight is about 1 lb., or just about one-half what a serviceable shovel would weigh.

This implement is intended to be used by a man kneeling and using one or both hands as best suits his convenience. The section of the knife is not a good one for carrying earth, and in practice the man has to use his hands to throw the earth to the front.

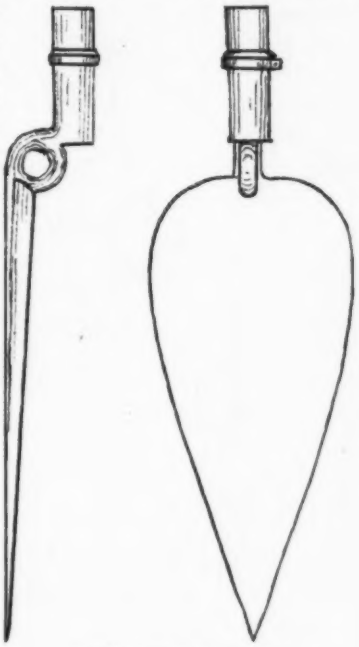


THE UNITED STATES ORDNANCE HUNTING KNIFE AND INTRENCHING TOOL.

The knife is too light to cut through sod readily, is so thin as to be bent easily, and if used in stony ground would be soon disabled. The smallness of the blade allows so little earth to be thrown out at each stroke that the time necessary to dig a shelter pit is considerable, and the construction of any other form of shelter is entirely out of the question. Using this implement in intrenching would soon render it useless as a knife, as the edge would become so dull as to prevent its use as a cutting tool. The men set small value on this tool and very generally say that they would rather carry a larger and more effective tool even though it should weigh more.

Rice's trowel bayonet, another American intrenching tool, consists of a thin, slightly-curved blade of steel welded on the ordinary bayonet. It is intended to be used as a tool for intrenching purposes, being then detached from the musket; the loop connecting the shank and base of the blade serves also as a guard for the fingers while in the act of digging. A similar blade may

be attached to the ordinary sword bayonet handle, which, though much heavier than the first described, affords a more convenient grasp for the hand. While it was thought that this was a very good thing in its way, still the liability that the tool would be employed while on the muzzle of the piece caused a tool to be substituted for it that could by no means be used in this way. This tool is made of a sheet-steel blade, turned up on one edge, and slightly curved cylindrically near the point; it is set in a slight wooden handle split for its reception and securely riveted through the tang of the blade. In one form of the implement the lower edge is cut into saw teeth. This form was intended for exclusive use as an intrenching tool. On the trial of the bayonet three laboring men in 4½ minutes threw up an embankment 20 inches high, 30 inches wide at the base and about 8 inches at the top, and 5½ feet long, from an area of ground of 6½ feet by 5½ feet and 5 inches deep, which concealed them from observation when they lay close to the ground.



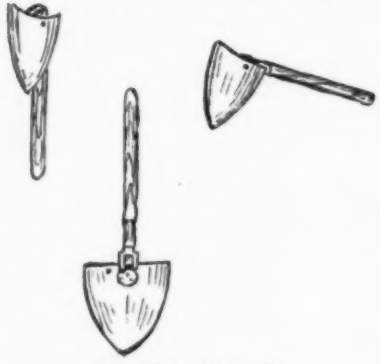
RICE'S TROWEL BAYONET.

Both of these tools have the same disadvantage as the knife, *i. e.*, they are too small and light. However, the trowel bayonet is much the best of the three, in that it can be used as a sod cutter much more effectually than either of the others, and is by no means to be despised as a weapon; but in securing its lightness and portability the other necessary qualities have been sacrificed.

The Patterson spade is intended to combine the virtues of a spade and hoe, and can be changed from one to the other by turning the blade about an axis perpendicular to the handle. It consists of a heart-shaped steel blade to which is attached a lug by means of two rivets, the lug being grasped by a sleeve of brass

and revolving on a bolt at right angles to the axis of the sleeve. Three holes are bored in the lug to receive the end of the handle, which is secured in the sleeve by means of a thread cut in the inside surface of the sleeve and on the outside of the handle. These holes are so arranged that inserting the handle in one gives a straight spade, in another gives the hoe, and in the last one the blade is folded back flat on the handle for convenience in carrying. A small hole in the blade allows the passing of a hook by means of which the spade is attached to the left side of the belt. The blade is about 7″ wide by about 8″ long, the entire length being about 20″, and the handle having a diameter of about 1″; the spade weighs about 1 lb. 9 oz.

The idea may be a good one, but the sacrifice of strength, necessary to accommodate the mechanical details and to get the lightness, is so great as to render it unable to stand the rough work that falls to an intrenching tool, the lug being too small and the manner of attachment too insecure for use. Its weakness was shown in tests made at Fort Leavenworth, where it broke during trial, before the first sod was raised, the lug separating from the blade and shearing the rivets clean. The idea is by no means new, a spade of this kind having been invented by Captain Harrison of the London Engineers. Harrison's spade had a pick welded to the back and top of the blade, so that when the blade was down at right angles to the handle, the tool took the form of a hoe on one side and on the other the shape of a pick. The blade had a hole through it to admit the muzzle of the piece, allowing it to be used as a shield when the pick was driven into the ground and the blade turned up. I hardly think that this form of tool will ever be adopted for use, on account of its manifest inability, constructed as at present, to do the work required.

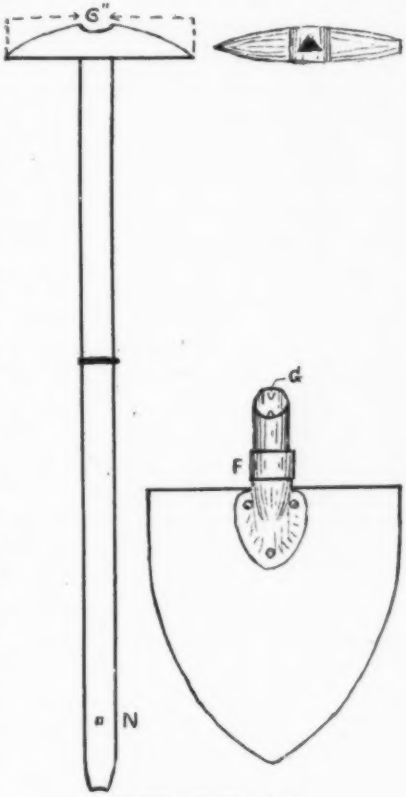


THE PATTERSON SPADE.

The Underwood spade, the invention of Colonel Underwood, 4th and 5th Hussars, British service, is a compromise tool combining a pick, a grubber, bayonet scabbard, rifle rest, and spade.

The handle is of steel made hollow for the purpose of containing the bayonet, thus allowing the bayonet scabbard, usually worn, to be dispensed with; its length is 1′ 10.6″ and total weight is 27 oz.

The pick is of steel and is welded to the upper end of the handle; the blade is of steel, heart shaped, 8″ long, and 7½ wide at the top, and is 1″ thick; it weighs 24 oz.

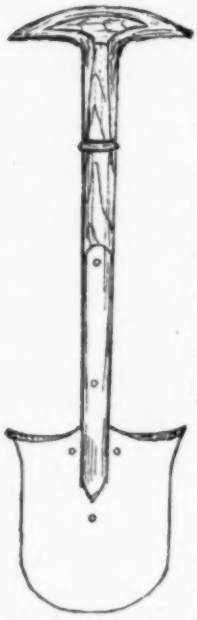


THE UNDERWOOD SPADE.

Attached to the top of the spade blade is a socket with two lugs, the socket tapering and having a sliding collar. To assemble the spade, the handle is placed in the socket, engaging the lugs G in the holes N, and then the collar is slid up over the socket, forcing the lugs home and holding them in place. The blade is carried in a leather case on the right side, and may be used as a shield by hanging it on the buttons of the coat; the inventor claims that it will deflect bullets at distances exceeding 200 yards. The handle is worn on the left side as a bayonet scabbard. The inventor in his description says that the spade has a greater digging power than the Linnemann or Wallace shovel, and that it is strong and durable. Trials at the U. S. Infantry and Cavalry School developed weakness in the fastenings, one of the lugs breaking off during the first trial. The rifle rest is used by sticking the handle in the ground and resting the piece in the notch at the top. This spade also belongs to the compromise class, and, being in two parts, is more liable

to become disabled than one complete in itself. The advantage of the long handle in digging is incontestable, but is overbalanced by the many disadvantages of a jointed tool; for if it is once damaged in the socket or handle, it cannot be repaired in the field.

The Wallace spade is of steel, 23″ in length, and has a steel-shod crutch-handle. The steel covering of the crutch is made so that one end can be used as a pick and the other as a grubber. The blade is of steel, 7.25″ long, and 5.25″ wide, and is of sufficient strength to allow of small wood being cut readily. Its weight is about 2¼ pounds. The inventor claims advantages from its use as a shield at long ranges against rifle bullets, and also as a weapon at close quarters.



THE WALLACE SPADE.

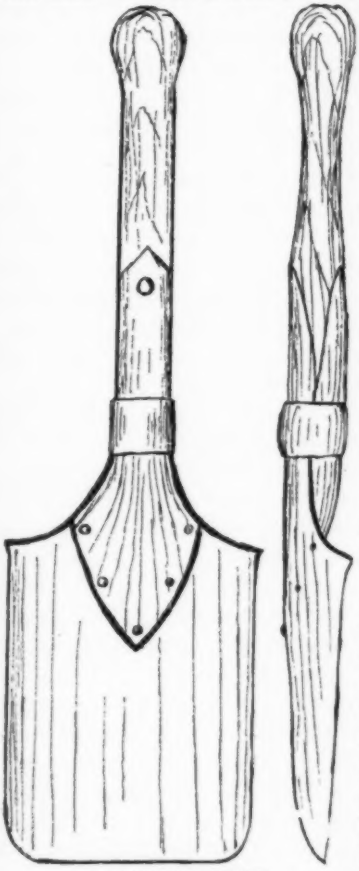
Some of the regiments in the British service are armed with the Wallace spade, but the men do not like it at all, as the blade cuts the trousers and the tool is awkward to carry. This could be remedied by carrying it upside down and wearing the blade up; but, even then, the crutch would be in the way. Some officers say that it can only be used in soft soil and is useless when stony ground is met with. This tool is a good one of its kind, but lightness is sacrificed to the crutch handle without a corresponding gain in efficiency, as is generally the case in all compromise tools.

The Linnemann, used by Germany, Austria, Holland, France, Russia, Roumania, Servia, and Greece, is made of steel, and has a length about 20″ over all. The blade is 6″ wide, and 8″ long, and has one side cut into saw teeth, the other being sharpened so as to act as a cutting edge. Its weight is from about 1½ to 1¾ pounds.

Some of the countries that use this shovel think highly of the saw, but Germany, France, and Russia do not use it at all, holding that it is better to carry the necessary tools of other sorts, such as picks, bill-hooks, saws, etc., as the compromise tool does not fulfill the conditions of all the implements represented.

In using this spade, the soldier presents his left side to the enemy, bends the right knee, and takes the handle in the right-

hand, seizing the collar of the spade with the left-hand. The shortness of the spade makes it necessary for the soldier to kneel or bend over very much. In the first case, the man is less exposed and more completely covered by the dirt thrown out; in the second case, he works more rapidly, and is able to cut the turf more readily.



THE LINNEMANN SPADE.

The second method is generally preferred by the men when not under the fire of the enemy and when the workers are relieved every 20 minutes. In stony ground it is necessary to help the work by putting the foot on the upper part of the blade. To employ the spade as a hatchet, the soldier takes the handle near the iron part of the spade and strikes it slantingly, the strokes falling as near as possible to the flange on the upper part of the spade. Trees up to 6″ in diameter can be felled in this way, and a hard wood tree 3″ in diameter has been cut down in 1½ minutes. In using the saw a horizontal cut is made first with the saw and then the notch cut out with the sharp edge of the spade. In my opinion this spade presents the maximum efficiency with the minimum disadvantage. It is strong, handy, and easily carried, and is a compromise in no sense of the word. Whether the saw-edge is an advantage or even permissible is an open question.

So, after carefully considering each tool in this list, we find only one that fulfills the conditions imposed, and that is the Linnemann. It is a good digging tool, it can be used for cutting small brush, and it does not sacrifice either quality to the other.

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The Linnemann is, according to my opinion, the proper type of spade to be used; but it is not by any means necessary that we should follow the exact pattern that is used in Europe, and I think that we should gain by using the same pattern of spade that is so familiar to us all. The Continental style has too much slope to the tread to allow of placing the foot squarely, and I am of the opinion that the square tread would be much better and would not materially decrease the strength of the tool. The weight should not be over two pounds—the lighter the better, for any gain in lightness that can be made, without weakness, is a distinct gain in efficiency.

These spades can be made very cheaply, and there is no reason why they should not be issued to the infantry in sufficient numbers to allow of 75 per cent. of the men being armed with them, the other 25 per cent. to be armed with the pick and hatchet. These picks and hatchets should not weigh more than two pounds, and should be worn in leathern cases as prescribed for the spade. They could be so distributed that each squad of 8 men would have 6 spades, one pick and one hatchet. This proportion would be sufficient in all but stony ground, and in such ground, picks of such size would be of little use. Even with the tools of the engineer park full sized picks would be necessary.

The average American soldier thinks that he is much overloaded at present, and regarding any further addition to his pack as an imposition, he dislikes the prospect of having to wear a spade. But the supposition that all the articles carried at present are necessary to the comfort and efficiency of the soldier is undoubtedly out of all reason, for our soldiers on the march throw away a large part of the pack, and still get along in a manner that is rather discouraging to those who insist that they *cannot* do without the so-called necessaries. I would suggest that the pack be reduced in weight by taking away those articles that are really luxuries to the soldier on the march, and, in lieu of the weight thus dispensed with, I would substitute a spade that is light and at the same time efficient. Taking the weight of the spade at 2 lbs., and remembering that no efficient tool has been produced that weighs less, the pack could be reduced over this amount by taking away only one of the articles carried, *i. e*, the extra shoes, 2¾ lbs.; or, if this seems too much risk to take, then the blue shirt and undershirt, weighing together 2 lbs., might be omitted.

In considering the proposed substitution, it must be remembered that, in each case, the old intrenching tool (the hunting knife), weighing 1 lb., would also be dispensed with, thus more than overbalancing the weight of the proposed tool. Better still, reduce the pack to the size and weight of the simple blanket-roll at first without waiting for the men to do it themselves; thus heeding the experience of our armies in the late war, where it was shown to be the only style of pack that the men would wear.

The item of weight can be set aside by reducing the pack; but there is another consideration that must be acted upon, and that is, that the men have not been accustomed to wearing intrenching tools as a permanent part of their equipment. In fact, in some companies they have never been taken out of the original boxes, and in others they are issued only on the eve of field operations. Thus the soldier unacquainted with the proper use of them justly complains of the addition of what he considers (and has been taught to believe is) an extra article to carry. I believe that the only way is to have the soldier carry the spade at all times, whether it is on the drill-ground or in the field, and he must be taught that it is as necessary a part of his equipment as the rifle. Unless this is done intrenching tools will be lost in the camp fire, in the same manner as the excess of weight in the pack disappears at present. The tool should never be attached to the pack, as this may be thrown off at any time and thus the man be disarmed, but it should be worn hanging from the belt on the left side so as not to interfere with the handling of the rifle. Except on parades, reviews, and guard duty in the post, the spade should always be worn and would thus become as familiar an object as the bayonet scabbard.

The mere fact of the men having the tool, however, will not in any way teach them its use; and, therefore, thorough instruction in the manner in which it should be employed is neecessary. In order thoroughly to instruct the soldier, he should be taught what value the different sorts of field intrenchments have against the rifles now in use, and the thickness of earth necessary to stop bullets at any distance: he should be shown the proper manner of using the spade, so as to employ his time to the best advantage, and then required to drill at trench digging as regularly as he at present goes through the setting-up exercises. He should be taught the proper length, breadth, and

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depth of the different kinds of shelter, and required to dig them. Certain trenches have been practically adopted and authorized in our service by the order designating the English Field Engineering Manual as a text-book. He should also be taught the use of the spade as a cutting tool in felling brush for gabions, fascines, revetments, etc., as it can be used for all these to advantage, and the large proportion of men carrying them makes possible a vastly increased rapidity in the construction of such material.

The advisability of the saw edge should be considered here, in view of the fact that comparatively large trees can be felled by its aid, and as the existence of the saw does not necessarily bind one to its use, it might be placed on the spade without diminishing the usefulness of the latter as an intrenching tool in the least. In some foreign armies the custom obtains of requiring each company to construct a certain number of yards of trench annually. In the given number of yards is included all kinds of trench used, and in this way the men learn to appreciate what these tools are and how they may be made valuable.

In regard to the use of the spade, Captain C. Von Widdern says: "In the attack, as in the defense, it is most desirable that the spade should be utilized as much as the rifle and bayonet. It is high time to accustom the infantry to consider this tool, equally with the rifle, as an arm from which it can obtain profit, not only on the defensive, to resist the attacks of the enemy, but also on the offensive, especially in order to promptly put a newly-captured position in a state of defense and to thus ward off any offensive returns." Again, in regard to their use during the engagement, he says: "Even during an engagement the infantry threw up earth at every step and placed the edges of villages and woods in a state of defense, and this too, as much on the offensive to secure the positions gained as in the retreat to hold on to the ground."

The constant failure of works, made beforehand, under the impression that the line of battle will occupy them, has made it absolutely necessary that the men carry tools and know how to use them at very short notice on the field of battle; and this result cannot be obtained without very thorough drill. The main thing is to get the spades; but even if they were adopted in the U. S. Army they would probably suffer the fate of the many substitutes that have gone before, and be carefully treasured in the company store-room, only to appear on stated occasions, for the

purpose of allowing an inspector to certify that the company was equipped properly. Once issued to troops, the company commanders should be required to exercise the men in their use, and should be held responsible that they are used properly, and that the men are thoroughly instructed in all that pertains to the construction and use of hasty intrenchments. When the annual inspection of companies is made, the men should be exercised in this drill. This would show clearly how the work was done, and from it could be judged whether the men had been properly and sufficiently instructed. In this manner we could be sure that the men would, at least, have two tests annually. Companies failing in either proper selection of ground or in the proper construction of trenches, should be allowed a sufficient time to come up to standard, and then be inspected by the post commander, who would submit a special report, stating whether the men were behind in their work on account of insufficient instruction, or because of a large proportion of recruits lately received. In the latter case, the extra time allowed will insure their proper instruction at once; in the former case, extra drill should be imposed till all were up to the requirements. Should such an idea be carried out, we might hope, in two or three years, to find the infantry in some state of efficiency as regards this secondary, but vitally important arm of that branch of the service.

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THE MEDICAL DEPARTMENT OF THE ARMY.

By Major CHARLES SMART, Surgeon U. S. A.*

OF late years the relative importance of certain duties of the military surgeon has undergone a material change. Formerly the care of the sick and wounded was his all important duty; he was a military general practitioner. Now the preservation of the health of the troops is his first care; he has become a military sanitary officer. The framers of the Army Regulations of 1818 had the wisdom to provide that when troops were in quarters, the surgeon should from time to time inspect the rooms and kitchens, quality and preparation of the food, and the location and condition of the vaults, reporting defects and suggesting improvements to the commanding officer, who was directed thereon to issue such orders as he might think necessary and proper. This was the entering wedge which split up the massive ignorance and despotic rule that came to us from the days of feudalism. It is true that earlier regulations required the surgeon to do all in his power to prevent and eradicate contagion; but this was aimed at hospital contagion,—hospital gangrene among his wounded, and hospital fever, the redoubtable typhus, among all classes of hospital inmates,—and gave him no power over the general well-being of the troops. For a long time the provision which made the surgeon a sanitary inspector was a dead letter. He fulfilled the requirements of the regulation by inspecting and reporting until he became tired of being treated as officious and meddlesome by commanding officers who resented this performance of duty on his part as a reflection on their efficiency, and never considered it either right or proper to issue orders on his recommendation. In the course of time, however, the progress and popularization of sanitary science were such that commanding officers did not dare to pass unnoticed the suggestions of their medical officers, and as a consequence sickness became less prevalent, and the military physician had more time to study practical sanitation. At last it became recognized generally that

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prevention was better than cure, and the army medical officer ceased to be primarily a general practitioner, in becoming the administrative officer of a sanitary bureau, with certain clinical duties when accident or the failure of preventive methods placed the individual soldier for special care in a hospital ward. To appreciate what the army surgeon has accomplished as a sanitary officer it is only needful to consider a brief extract from the records of Baton Rouge, La. This, a large post of 400 or 500 men, lost by death annually an average of 210 men per thousand of strength during the six years 1819–24. In the year of greatest mortality, 1822, the loss was 260 per thousand; nor was any great epidemic sweeping its tens of thousands from the face of the country during these years; the citizens of Baton Rouge in the vicinity of the military post were healthy. Could such a thing happen in these *fin de siècle* times during a period of peace and prosperity? In reply it need only be said that the mortality of the United States Army from all causes in 1891 was 8.05, and the average annual rate of the previous decade 8.82 per thousand living.

This preservation of men from sickness and death, has been accomplished by the medical officers of the army in the face of many difficulties, chiefly attributable to ignorance and its narrow minded economies. These he has fought earnestly and perseveringly. He has been defeated time and again, yet has always returned to the struggle as soon as the progress of time and science has reinforced him with fresh data bearing on the point of attack. It may perhaps be said that in developing his status and power as a sanitary official, the military surgeon became less attentive to his duties to the individual; that his ability as a sanitarian was purchased at the expense of his experience as a practitioner. To discuss this point is beyond my present province; but I am willing to admit that had all the energies of the Army Medical Department which have been expended in lessening rates of sickness and mortality been devoted to perfecting a system for the care of the wounded in battle, a medical officer in discussing this subject at the present time would have been able to speak from a platform of better considered and selected ideas than now supports our methods of field management. I must not here be understood as meaning that during the years of sanitary progress no attention was given to the responsibility that would fall upon the Medical Department in the event of war. On the contrary the great War

of the Rebellion demonstrated that an efficient system for the care of the wounded was one of the grand divisions of military sanitation; and continued efforts have been made to build up our methods on the foundation of experience which we then gained. That war enlarged our views, and it lasted long enough to enable us to develop a system based upon the enlargement, and to show us what was needful to the successful carrying out of the system. We began the war with methods borrowed from Europe. We ended with methods that were developed by the cries of our wounded for relief. We realized that to enable a medical department to care properly for the wounded of an army it must have full control of all the men and material needful to this end. At first the Quartermaster Department had control of the ambulances and medical wagons, and nothing could be done by anxious medical men without efficient coöperation on the part of these other officers; and as the litter-bearers and nurses were subject to the orders of regimental commanders, many a medical officer found himself in the early days of the war with no hands but his own to give succor to the wounded on the battle-field. These difficulties were overcome during the progress of the war by makeshift organizations and the coöperation of general officers in command of divisions and corps; but on the return of peace medical methods retrograded to their ante bellum status, or that prescribed by the army regulations of the time. This was so unsatisfactory to those who saw clearly the difference between what was and what might and should be, that every effort was made to reorganize the Medical Department in accordance with the experience of the war, that the fruits of that terrible ordeal might not be permitted to decay for want of care and storage. Difficulties were encountered. The country had been surfeited with war; Congress was slow to move in anything that looked like building up the armed power; so that it was not until twenty-one years after the close of the war that the Medical Department of the army was authorized to provide itself with that which the war had shown to be indispensably necessary to the proper care of the wounded, viz.: a body of men specially trained for the performance of this particular work.

In 1887 a law was passed establishing hospital corps, and since then the best energies of the department have been devoted to educating the personnel and perfecting the organization of this corps, and formulating the methods by which it will accomplish

its work not only under conditions of peace but under those of Indian or of modern warfare.

The recruit for the hospital corps is selected and enlisted by the medical officer ; or, if he enter the corps by transfer from the line, it is on the application of the same officer. Hence, if the department fail to have suitable men, physically sound, mentally capable and morally trustworthy, the fault will lie with its own officers. How different this from the previous status, when medical officers had to do what they could for the injured with such men as nurses and assistants as a commanding officer was pleased to place at their disposal. The recruit is then sent to a post or company of instruction for drill, discipline and education. At present there are two companies of instruction,—one at Fort D. A. Russell, Wyoming, the other at Fort Riley, Kansas. Here all are set up as soldiers and are taught the practical details of first aid to the wounded and the principles of nursing. Those who manifest a predilection for a special line of work have every facility afforded them for developing their usefulness. Some give special attention to cookery, others to pharmacy, others again to the symptoms, progress and management of disease, while the more intelligent and ambitious of the men extend their course of study with a view to becoming hospital stewards.

The system of hospital corps drill was elaborated with much conservatism. Many medical officers, particularly those of large experience in actual war and whose views carried corresponding weight, were opposed in toto to any system of drill. Litter drills were known to have been a failure in the Army of the Potomac at Falmouth, Va., in 1862–63 ; but this was not surprising considering the circumstances. The men then attached to the hospitals looked upon the proceedings with dummy wounded as a kind of joke,—an amusement to relieve the tedium of winter quarters. They had carried wounded men from the field at Yorktown, during the seven days in front of Richmond, and but a short time before from the lines of battle at Antietam and from the foot of the impregnable heights of Fredericksburg, and they naturally regarded this make-believe work as illustrating the stupidity of those in authority, who sent young assistant surgeons, to whom the whistle of a passing bullet was as yet an unknown sound, to superintend the field-work and teach them how to handle wounded men.

There was, moreover, a prevalent opinion that the gentle hand-

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ling of a wounded man was inconsistent with the sharp tones of military command, and that any attempt to coördinate them would bring ridicule on the medical officers concerned in it. At the same time it was recognized that there was no better method than drills by word of command to perfect men in movements that required concerted action. A well-manned battery keeps up a rapid fire because every man knows the duty devolving upon him and does it without command at the precise moment when it should be done; but this perfection of coöperative work is attained only by repeated and careful drills in the consecutive movements each executed at the word of command. An analogous drill with the litter, ambulance and a representative of the human body, familiarizes men with the management of these objects and prepares them to act intelligently one with the other and irrespective of commands when the necessities of the occasion require such action.

Several years were spent in perfecting the drill. Provisional manuals were issued for the guidance of officers, with authority to deviate from the prescribed lines whenever they thought an advantage was to be gained. Now the approved Manual contains the best thoughts and experience of the earnest and active workers of the Medical Corps of the army. The best methods of handling a wounded man are laid down. The members of a litter squad, drilled in these methods, will at a word from their chief take each his proper position and be *en route* from the field with their burden before an equally intelligent but undrilled set of men would have decided upon the best way of lifting the injured man for transference to the litter. All the soldiers of the hospital corps are taught their duties as members of the little squad, to lift and carry in the best position, to relieve shock, stem hemorrhage, dress wounds, extemporize supports for fractured bones, and deal properly with unconscious patients whether the insensibility is due to injury, as in concussion or compression of the brain, to syncopic conditions, as in fainting, shock and loss of blood, or to congestive conditions, as in strangulation, drowning, asphyxia from noxious fumes, apoplexy, sunstroke, convulsions or narcotism from alcohol, opium, exposure to cold, etc. All are taught also the duties of hospital ward routine and the principles of nursing, as constituting, with their knowledge of first aid, the complete curriculum of their technical education.

When a soldier has reached this stage of his development he leaves the school of instruction for duty at a military post where

he is not permitted to forget what he has learned, and where, if he is able and ambitious, he will find every facility for advancing himself in knowledge, usefulness and position. After not less than a year of service as a private soldier, he is eligible for assignment as an acting hospital steward, provided he demonstrates his fitness for the position by passing a satisfactory competitive examination in arithmetic, army regulations, pharmacy, materia medica, first aid and hospital corps drill. Having gained this position and held it for a year he becomes eligible for promotion to the grade of hospital steward, provided he can show a satisfactory advance in the subjects above mentioned and a competent knowledge of minor surgery and the principles of military sanitation. The current duties of the Medical Department at a military post are performed by these men while studying to prepare themselves for any duties or responsibilities that the accidents of peace or the emergencies of war may bring upon them. The acting hospital steward gives special attention to the education of the private soldier. The steward develops the powers of his acting stewards and exercises a general supervision. Every member of the corps endeavors to bring those below him to his level, and the medical officer directs the whole, giving lectures, demonstrations and drills to familiarize the men with the management of emergencies and the application of field methods. To permit these drills to be carried out, and at the same time to provide for accident and the medical needs of the post, ambulances are allowed in proportion to the strength of the garrison, and these are under the immediate control of the medical officer, who is responsible that they are always fully equipped and ready for service.

The hospital corps is, as has been indicated, a self-educating body. It is the duty of the member who has been promoted to give a helping hand to those below him, and no jealousies interfere with its discharge because rank goes by seniority and the man who is now climbing can never antedate the man who is helping him. The members are possessed of all the facilities afforded by books, dispensaries, wards, surgical appliances and medical education. Every term of enlistment is a course of study giving greater value to their services by their increased experience. The records of their examinations show the progress made in their education. The prize for worthy members is promotion to the dignities, responsibilities and emoluments of a stewardship ; and this is highly

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appreciated because it is always before the eyes of the candidates in the person of the steward under whose command they perform their duties. With this ever present stimulus it is not surprising that, as the result of a year's study of pharmacy and materia medica, these eager and ambitious young men know more of these subjects than medical students who have taken their regular college course, but whose only stimulus is a medical degree with all sorts of uncertainties attending its future possession.

There are now in the United States service, educated in the manner described, 119 stewards, 88 acting stewards, and 607 private soldiers. Besides these there have been educated 39 stewards, 29 acting stewards and 778 privates who are not now in the corps, having obtained their discharge or declined reënlistment. Most of these stewards left the army because, with their qualifications, they believed they could do better for themselves in civil than in military life. The army system carried their education so high that their services became lost to their teachers. Many of them are now practicing physicians; but should a call to arms be sounded by the country these men would undoubtedly be prompt to respond. The enormous percentage of loss by refusal of the private soldiers to reënlist was due to dissatisfaction with the pay roll. From the passage of the organizing act until recently the pay of the hospital corps soldier was no more than that of the soldier in the ranks notwithstanding the importance and special character of his duties. He declined to reënlist in the corps unless he was looking forward to his advancement therein, in order to accept service in the line where immediate promotion and increased pay were secured by his intelligence and reputation. Now, however, that the pay of the private of the hospital corps has been made equal to that of a non-commissioned officer of the line, there will be less of a movement from the corps. Those educated by it will be satisfied to continue in its service.

It has been said of the educational work of the Medical Department that it is carried to excess,—and the loss of certain hospital stewards above referred to, has been instanced as proof. No doubt many of our hospital corps soldiers would do their duty as satisfactorily as litter-bearers and ambulance drivers although they knew nothing of many other subjects that form part of their educational course. It must be remembered, however, that the corps as a whole is a preparation for war, and that should war unfortunately occur and cause a sudden expansion of our military

forces, it is on the education of these men that the usefulness of new undrilled and uneducated additions to the hospital corps would depend.

Something must now be said concerning the personnel of the Medical Department. This consists of a corps of medical officers who enter the service by competitive examination, and are thereafter promoted by seniority, provided they continue to fit themselves for the increasing responsibilities of higher positions. As with the hospital corps so with its corps of medical officers, the Medical Department is itself responsible for the character and qualifications of its members. A board of medical officers selects its approved candidates from those who come forward for examination. Political influence, which has so much to do with appointments to the U. S. Military Academy, to the army from civil life, and to the staff corps from the line, is utterly powerless in appointing or promoting the medical officers of the army. The members of the examining board, jealous of the good repute of their corps, allow admission to none whose professional attainments are not such as to promise a satisfactory future record. These examinations were instituted during the War of the Revolution, and their continuance to the present day has kept the corps free from the demoralizing effects of political and social influence. In the present age, which may be called that of examinations for public positions, there is little likelihood of any relaxation of the strictness of these inquiries into the fitness of candidates for appointment.

The passed candidate, now a medical officer with the rank of lieutenant, is required to attend a course of four months at the Army Medical School in Washington, D. C., during which he is instructed in subjects that are not at all or imperfectly dealt with in the usual college curriculum. He is taught army regulations and customs of service, the rights, privileges and property responsibilities of officers, examination of recruits, reports of sick, methods of post hospital administration, of feeding, clothing, equipping companies of the hospital corps, and the care and transportation of the wounded and field hospital management. He is taught also clinical and biological microscopy, particularly as bearing on disinfection and prevention of disease, military hygiene and practical sanitation, that he may be able to give an expert opinion on all questions relating to the health of the command to which he may be attached. After this he is placed on duty, usually at first at a large military post where he is subor-

dinate to an officer of considerable experience, and where he becomes familiar with the duties of his office, including the drill and discipline of detachments of the hospital corps.

At the end of a five years' service he is promoted to a captaincy, having first undergone an examination to determine his fitness physically and intellectually for the performance of the duties of the grade to which he is to be promoted. The professional part of this examination is more military than medical. After this the army medical officer remains undisturbed by examiners for ten or fifteen years, or until his seniority brings him near the head of the list of captains, when he has to show to an examining board that his physique is still good and that he has kept up with the progress of modern medicine. Recently Surgeon-General Sternberg has favored those officers who are nearing the period of examination for their majority by assigning them for a year to duty as attending surgeons in such cities as New York, Chicago, Philadelphia, Boston, etc., so that they may take advantage of the hospital practice, lectures on special subjects and meetings of active medical societies. The army medical officer is thus kept well informed in his profession throughout the whole period of his service on the active list; for after having passed all his own examinations he may be assigned to the duty of examining others.

The members of the medical and hospital corps are attached to other military organizations but are bound up with none. They are subject to the commands only of their superiors in their own corps under the authority of commanding officers, and are all, with their equipments, property and transportation, under control of the Surgeon-General by virtue of the authority of the Secretary of War. The hospital corps soldier is not enlisted for a specific duty, but may be employed, to utilize his special qualifications to the best advantage, as a litter-bearer or an ambulance driver, cook, nurse, ward-master or orderly; the members of the Medical Corps may in like manner be placed on duty in command of ambulance or bearer companies, at collecting stations in the field, as operating surgeons, attending physicians, quartermaster and subsistence officers of hospitals, purveyors of medical supplies, inspectors, directors, etc. If the square peg is put in the round hole it is the fault or mistake of the management. Moreover, although the personnel and material of the department are based on the strength of military organizations, as so many ambulances,

etc., to a regiment of so many men, no part of the medical outfit has any connection save that of temporary attachment for duty with the regiment or other military subdivision. If one regiment suffers more than another, a suitable increase of medical strength can be placed at its service. In fact the full strength of the department can be thrown where, in the opinion of the medical director, it is most required. If anything is lacking in an emergency the failure must be attributed to want of foresight on the part of the medical officer in authority. Duty is well performed when responsibility is clearly defined and power delegated adequate to its support. Often and sorely was this realized by medical officers during the War of the Rebellion, as when all that had been provided for the wounded in a great battle was as if it had never been provided, because the Medical Department did not control the wagons which carried those invaluable supplies. All this is now changed; and under present laws and regulations there is every reason to anticipate that in the inauspicious event of active service for the military forces of the United States, its Medical Department would be distinguished for its excellent work.

It is recognized that in time of war the main reliance of the country would be the state troops mustered into the service of the United States. These, uniformed, equipped, drilled, disciplined and organized in accordance with the Regulations of the U. S. Army, would speedily become assimilated with the regular troops and form with them a national army. Similarly should the Medical Department of the National Guards be organized after the methods of the Army Medical Department, for it is as needful for the care of the sick and wounded of a large army that its medical officers be trained by the same methods, as it is for the military success of the command that each of its component organizations shall have been taught the same system of military tactics.

Were the methods of the Medical Department of the state military organizations the same as those of the United States Army the latter would have no difficulty in providing for the exigencies of war, for each accession to the strength of the army would bring with it its proportionate number of medical officers and soldiers of the hospital corps. Unfortunately few of the states have as yet recognized the necessity for making any change in their medical service. Regimental methods, in use in the days

of the Revolution, answer their purpose excellently in times of peace. The medical officer of a regiment lives in the same city or locality with its officers and men. He is always on hand if an accident occurs; in fact he is a kind of family physician to the command. He is present at sick call when the regiment is in its summer camp; and when it is called out for local service in strikes, he and his assistants and his detailed men have usually no difficulty in caring for the resulting casualties. The regimental system of medical service suits the existing conditions of the state military organizations. Their medical officers credit the army medical officer with understanding his own business, but think that he fails to appreciate the wholly different conditions existing in the state services. They consider him right in organizing a general staff corps for assignment to duty with parts of regiments scattered in garrisons all over the country, but hold him wrong in insisting on the adoption of his methods by the state authorities. They attribute his insistence to his ignorance of their local conditions and of the convenience of their regimental methods. In this lies their mistake. He is fully aware of these; but regards them lightly in comparison with the more important duties of war service. The *raison d'etre* of a military medical department is not to care for sick and injured men in times of peace. That could easily be arranged without a medical department. It is to have on hand a trained body of officers and men to provide needful supplies and professional care to the sick of camps and the wounded of battle. The training should be effected in times of peace, and the methods should be those that are to be used in times of war. Now the regimental system is incompetent on modern battle-fields. It is claimed sometimes indeed, that the excellent working of our Medical Department during the War of the Rebellion was effected under this system; but the claim should be rather that it was effected in spite of it. Our field division hospitals were organized by treating regimental medical officers as staff officers subject to the orders of medical directors, and irrespective of state or of regimental numbers; and the importance of the work done in them detached their personnel as completely from their regiments as if they had belonged to a special corps. In fact the medical work of the War of the Rebellion, which at first under the regimental methods was such as to cry aloud to the country for help, and to bring into existence the sanitary and Christian commissions and many state aid societies, became after the organization of the

field hospitals a very model for the armies of the civilized world. To effect their organization the medical and hospital systems now in use by the National Guard of most of our states, and then in use in the army, had to be broken up in favor of a medical staff with a special corps of hospital and ambulance men such as the army now possesses,—and such as army medical officers now urge upon state military authorities.

Such a similarity of organization is hoped for by army medical officers in the not distant future, that they may have as full an assurance of prompt and efficient assistance in the work of caring for the sick and wounded as is already felt by the army generally concerning the loyal support that would be brought to the national standard by the well drilled battalions from our various states.

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THE INFANTRY AND CAVALRY SCHOOL AT FORT LEAVENWORTH.

By Captain W. H. CARTER, 6th U. S. Cavalry.

THE Infantry and Cavalry School at Fort Leavenworth, Kansas, was established in 1881 by a general order from the headquarters of the army. The school was not very popular with many of those detailed to take the course during the early years of its existence, and a good deal of ridicule was cast upon it, culminating in the nickname of "Kindergarten." Much of this feeling arose from the fact that the course had to be fitted to some weak members who had gained entrance to the army under the loose methods of examination prevailing at that time.

The steady progress which has been made in most departments has long since caused the name of "kindergarten" to disappear, and now the majority of young officers are not only willing but anxious to enter the school, to test their powers with their many brilliant young comrades, and to profit by the professional training now given. The school has many opponents in the service who believe that all the training a young officer needs may be had with his regiment, but fortunately this opinion is not likely to operate seriously, although it would be a great advantage to have the school held in high esteem throughout the army.

Unfortunately, whenever any change is introduced into our service, it is pursued wildly until it is killed by its own extravagance. This is the course now being pursued at some posts in regard to recitations and lyceums, all of which may react some time on the service schools.

There is generally within the knowledge of each officer some practical soldier who has never been taught theory at school, and whose success causes him to be pointed out as a complete refutation of all claims that theoretical knowledge of war is necessary. Those who argue in this way are especially fond of naming generals of the late Civil War, but a careful scrutiny of the names of general officers, both Federal and Confederate, who became prominent, will convince the most skeptical that those who had received previous military training far out-stripped those who had not;

and that those volunteer generals who made lasting reputations did so in spite of their lack of previous military training and not because of it.

The nation always takes much encouragement for the future through its triumph over difficulties in the past, but if any of the costly lessons of the Civil War are to find a permanent abiding place in the minds of Americans, none should be more thoroughly absorbed, than that the military profession is not one in which men, successful in other pursuits in life, can necessarily reap honors; that commanding large armies is no mere holiday affair; and that a successful conduct of war,—that which obtains a maximum of good results at a minimum of cost in blood and treasure,—is only to be expected of men of rare ability, coupled with much previous military study and experience. The history of the Rebellion teaches most emphatically that the greatest and most lasting results were uniformly the work of professional soldiers, trained in the art of war.

Ever since the formation of regular armies the tendency to higher education has increased, and in these modern days the success of armies depends fully as much upon the ability and professional qualifications of the officers as upon the courage of the men.

The necessity for military education was recognized in this country at an early day, for President Washington, in urging the establishment of a school at West Point, subsequent to the close of the Revolution, sent this communication to Congress: "Whatever arguments may be drawn from particular examples superficially viewed, a thorough examination of the subject will convince that the Art of War is both comprehensive and complicated; that it demands much previous study; and that the possession of it in its most improved and perfect state is always of great moment to the security of a nation."

Purely practical soldiers are apt to formulate false theories, while theorists are quite apt to make false application of good principles. A happy combination of theory and practice, as is contemplated at the Fort Leavenworth school, should, with a reasonable regard for examples of history, give the best results. While no books will supply the place of instinctive genius for war, the best type of soldier will always be he who can on the field of battle, with its turmoil and strange scenes, turn theory into practice.

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War has become more and more an absorbing special profession, and it is safer for the country to trust its welfare to instructed officers than to leave its fate to the inspiration and patriotism of untrained volunteers.

In the absence of an army of moderate size, it is very important to have at hand the largest number of officers, not only educated in the theory of war, but familiar with all modern improvements applicable to guns, ammunition, and material of all kinds; with electrical service; with the transport service; accustomed to handling men and performing all the duties of line and staff incidental to actual war, so far as it is possible to learn these requirements in peace.

It could not be expected that a school of application, with a limited number of friends in the service, could accomplish all that is desired in the few years it has existed; especially when it is considered how great a variety exists in the previous educational advantages of the student officers, coming as they do from West Point, civil life, and by promotion from the ranks. With few exceptions all the young officers have had the advantage of some college or first-class school, but the methods of mental training have varied so greatly as to inconvenience the school staff in grading the course to be pursued from time to time.

Since the school has been in operation and excluding the present class, two hundred and thirty-four officers have reported for instruction. Of these one hundred and eighty-five were graduated, sixteen were found deficient, and thirty-three failed to complete the course for various causes. The present class consists of forty-four officers, two of the forty-six who reported originally having been detailed as instructors at colleges. The graduates were apportioned as follows:—eighty-one from the Military Academy, forty-seven from the army, and fifty-seven from civil life.

The course pursued now covers two years, and embraces the following subjects in the various departments:—

MILITARY ART.

Wagner's "Service of Security and Information."
Wagner's "Organization and Tactics."
Hamley's "Operations of War."
Kriegsspiel.
Pratt's "Précis of Modern Tactics."

ENGINEERING.

Johnson's Surveying.
Richards' Military Topography.
Manual of Field Engineering.
Clark's "Building Superintendence."
Walke's "High Explosives."
Signalling.
Photography.

INFANTRY.

U. S. Infantry Drill Regulations.
Batchelor's "Infantry Fire."

CAVALRY.

U. S. Cavalry Drill Regulations.
Fitzwygram's "Horses and Stables."
Dwyer's "Bits and Bitting."

LAW.

Davis' "International Law."
Cooley's "Constitutional Law."
Winthrop's "Military Law and Courts-Martial."

HYGIENE.

Woodhull's "Notes on Military Hygiene."

Constant effort is made to improve the course and commendable progress has resulted.

The value of practical exercises and also of good models is thoroughly appreciated by the school staff, but as yet it has been impossible to perfect this part of the instruction. In the engineering department models are a paramount necessity, and the same may be said of the department of hippology, which title was adopted to cover everything that relates to the horse, including veterinary science, seats and saddles, bits and bitting, the theories of equitation and traction. No practical work in equitation is required, and a great deficiency of models exists. The course in traction might profitably be extended to cover transportation in general, and the department should be provided with working models of all army means of transportation and harness.

In connection with practical ponton work, it might not be amiss to require proficiency in swimming, without making it a special part of the course. Strange as it may seem, the official

records show that as many line officers have been drowned in the army during the last twenty years as in the navy, and this includes the large loss to the navy by the sinking of the *Huron*. As navy service is for the most part a service afloat, this anomaly can only be explained by the instruction and better appliances for life-saving in the navy and also by the greater danger of our western rivers when flooded.

The School of Application bears little resemblance to the infant "Kindergarten" of years ago, either in the class of instruction given, or the interest manifested by the students. It has slowly but surely been placed upon the highway of prosperity, but there is a continuous and loud call for further advancement, which should be met in the near future.

One of the first duties the War Department owes to this school is to take some steps towards eradicating the slight prejudice existing in the service because, it is claimed, there is too much theory and not enough practice. As a matter of fact, in many regiments where this feeling exists, practice is confined as a rule to troop and company drill with a very small number of men, and occasionally a squadron or battalion drill. If therefore the necessary arrangements can be made to make the practical part of the instruction at the school far superior to any to be obtained at any other station, the entire foundation for objection is removed, provided the number of officers under instruction is not so great as to throw an excessive amount of routine duty on those who remain with their regiments.

At present the practical instruction in the two departments of "Art of War" and "Engineering" covers a very important range of subjects in field work, comprising, for the department of Military Art, marches of concentration, advanced guards, rear guards, outposts, reconnoissance, attack and defense of positions, and practice rides. During these rides the student officers are given problems in the selection of positions and the disposition of troops according to the actual terrain, the troops being of course imaginary.

In engineering the practical work consists of an excellent course of plane and topographical surveying, particular attention being given to road and position sketching, mounted; construction of field works, trestle and spar bridges and other similar work; use of range finders, the field telegraph, field telephone and photography; particular attention being given to copying of

maps. Reconnoissance work is very thorough and of great practical utility to young officers.

The absence of real field service in the army of late, renders it necessary to provide for a simulation of it. While there is no better school for testing young officers and giving them self-confidence than the Indian scouting of former years, instruction should be on the lines of civilized warfare. Herein lies the opportunity to popularize the School of Application by giving the students, instructors and officers of the Fort Leavenworth and neighboring garrisons, a course of carefully planned field service every year, or at least every other year.

A glance at the map will show what a grand reservation the Government has here, obstructed only by a few wire fences which could be removed in part, or left for troops to remove as becomes necessary in the practice of war problems.

The permanent garrison consists of four troops of cavalry and eight companies of infantry. Suppose it is deemed best in the interest of economy to have the field exercises once for each class. They would then be held during the autumn of the second year,—say from September 15 to October 15. The troops and companies should be increased by recruits to not less than seventy-five men each just before the encampment, so that there would be about the usual percentage of partially instructed men that would occur in war. The garrison should be ordered into camp on September 15 with rations for thirty days and equipped for war service. Every organization should have a full complement of officers, by transfers from other posts if necessary. This would give four troops of cavalry and six companies of infantry, leaving two companies for the protection of public property at the post.

As there is a regiment of infantry at Fort Omaha, which could arrive in six or eight hours, it should furnish six companies, filled to the maximum number of officers and men allowed by law. This will give three battalions of infantry, organized as a regiment will probably be in any future war.

Another regiment of infantry could be assembled from Fort Sheridan and other stations within the department, and if the first field exercises were considered successful, a greater number could be assembled for the next class.

With these line troops should be a detachment of engineers with ponton train, a signal detachment with field telegraph, and a hospital company with a field hospital and ambulances. One

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light battery should be marched from Fort Riley for duty with the command throughout the exercises.

The garrison at Fort Riley should operate in connection with the troops at Fort Leavenworth, but should not combine with them until all exercises requiring their action as an opposing force have been concluded.

The work to be done should all be carefully planned beforehand. The first week could be profitably spent in giving the students and other officers instruction in camp sanitation, construction of field works and ponton bridges; use of machine guns, field telegraph lines and search-lights; mounted and foot reconnoissance and outpost duty. The students should be required to act as assistant-adjutant-general, assistant inspector-general, aide-de-camp, chief commissary and chief quartermaster in turn. Every student should be required to compute the ration, forage and transportation allowances of the brigade or division, as may be assembled, but no attempt should be made to call a regiment a brigade, or a brigade a division. The reservation would give ample room for the first week's work.

In the meantime the cavalry and a light battery from Fort Riley should start on a raid towards Leavenworth, to be met there or at such other point as might be ordered. Then combined work could be given the commands and the Fort Leavenworth camp broken up, and the troops marched, not less than a hundred miles, for instruction in marching, camping, advance and rear guard duty, patrol, etc.

The field exercises would admit of a great variety of instruction, under better conditions than are to be found elsewhere in the army, and if carried out in a proper spirit would without doubt prove of great benefit to all the younger generation who have not had the same opportunity to see service that their seniors have had. All the older officers who served during the Rebellion and have not attained the rank of major, could be excused from participating upon their own requests.

What has been here outlined may seem at first glance to call for too great an expenditure. If this be true, then let these exercises take the place of target competitions each alternate year, and the army of the future will not be the loser by it. Target practice is a necessity, but the practical education of young officers and men for field service should far outweigh all other considerations. That such instruction as is here outlined is beyond

the capacity of any one post cannot be questioned. That it would popularize the school and be of marked benefit to its students, is equally true.

While no field exercises can be made an exact imitation of field service, owing to the absence of the armed and alert enemy, nevertheless the student who is unable to apply his theoretical teaching in this case, would be more seriously hampered by the confusion and bullets of real war, and his failure should be considered in the remarks upon his diploma.

Civil service reform makes headway very slowly indeed, but the day will surely come when the President and members of Congress will demand relief from the incessant importuning and wrangling of army officers over staff promotions. At such a moment it will be an easy matter to pass a law providing that all appointments to staff departments open to officers of the line shall be made from the seniors of the next lower grade who have passed their examination for promotion in their own branch; and requiring all examining boards to express an opinion as to whether each officer is fitted for any particular staff position, *due weight being given to diplomas from service schools.* Such a law would popularize service schools and vitalize the perfunctory efforts of many officers with despondent natures. Hope of reward with the class of gentlemen composing the army register is of far greater weight than any fear of punishment, for it is rarely necessary to administer the latter, while the former would permeate all grades. The knowledge that future promotion would be affected by the efficiency of to-day would cause intelligent and constant effort toward perfection at all times, and hence redound to the great good of the service as a whole.

Under such conditions, if service schools do not produce great generals, they will at least provide a body of trained staff officers capable of taking rank next after the natural masters of war.

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AN INFANTRY OFFICER'S FIELD EQUIPMENT.*

By Lieut. W. H. JOHNSTON, Jr., 16th U. S. Infantry.

IT is hardly necessary to say that this paper refers to the material equipment alone of an infantry officer, presuming that his admission to the service is sufficient guaranty of proper mental and moral equipment for the duties to be assigned him. And more precisely does it refer to that portion of his equipment which must be carried upon the officer's person.

But before reaching a discussion of this, the most important part of his equipment, I shall mention briefly the essential articles of his baggage, transported either on wagons or pack animals, this portion of the equipment being necessary alike to mounted and dismounted officers.

FIELD BAGGAGE.

Our regulations limit the baggage in the field of captains to two hundred, and of lieutenants to one hundred and fifty pounds; certainly a liberal allowance and one that will doubtless be reduced in active operations. In the British service the allowances are eighty pounds for field officers, fifty for mounted and forty for dismounted officers. Each has, however, a trunk, not to exceed one hundred pounds, which is left at the base of operations, except when the commander-in-chief deems it advisable to permit the presence of this baggage with the troops.

I have no sympathy with the claim of some radical reformers, that the officer's equipment should not exceed in weight or comfort that of any of his men. The superior mental and physical exertions which may at any moment be demanded of him, require increased comfort and greater precautions for the prevention of sickness. An amplification of this just and reasonable principle accounts for the relative baggage allowances, tentage and other privileges of all officers, it being considered that an officer can be less easily spared or replaced the higher his rank. On the other hand no officer's baggage should exceed the actual requirements of his comfort and health, not only to avoid overloading the wagons, but also to prevent disaffection among the men, who

*Read before the Lyceum, Fort Douglas, Utah, February 20, 1894.

might and would grumble over the extra fatigue involved in loading and unloading the elaborate equipage of a captain more exquisite and selfish than soldierly.

The least dispensable article of an officer's baggage is undoubtedly his bedding, whether this be an overcoat and saddle-blanket, a blanket-roll over the shoulder, or a luxurious bed on spring-mattress and cot. There seems to be little difference of opinion about the best kind of camp-bed. It is a sleeping-bag of light-weight canvas lined with sheepskin, buffalo hide or other fur, the hair or wool turned in next to the bedding. This should be seven feet long, three feet wide and six inches high (outside measurement) when full, collapsing when unoccupied. The seams should be double-lapped after the fashion adopted in tent-making and the canvas soaked in oil, painted inside with varnish or lined with thin rubber waterproof. Inside should be a similarly shaped bag of cotton flannel, which could be removed and washed when opportunity offered. The only entrance to the bag should be a transverse slit two feet long, about one foot from the head and in the top of the bag as it is laid out for use. No mattress is needed, the sheepskin or fur answering the purpose, especially when it is possible to throw grass, branches or bushes under the bed. An eider-down quilt (possibly two) inside, makes the warmest and lightest cover.

In the space inside the bag and above the slit (one foot by three) the officer's extra underclothing, flannel and cotton, towels, socks, handkerchiefs, stationery, shoes, slippers or moccasins, candles, matches and tobacco should be packed in pockets of appropriate size, the hard articles at one side and underclothing, preferably woollen articles, in the centre, just under the head. Into the side opposite these hard articles should be slipped a linen case containing soap, in a metallic or celluloid box, comb, hair, tooth, shaving and clothes brushes, razor strop and razor, oil for the shoes, etc. A smaller case containing needles, thread, buttons and scissors should be carried in the same pocket. All the above, absolutely essential in the field, constitute, when carefully packed, the officer's pillow. A flap about two feet by one of white cotton, containing a layer or two of cotton batting, should ordinarily hang inside the bag from the top of the slit, and be pulled out and turned up at night to protect the head from the rough canvas cover. Over this a pillow-case should fit, to be detached and laundried when convenient.

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For the greater protection of the head in wet and cold weather, a flap of canvas, oiled, varnished or waterproof-lined, three feet square, should be sewed along the head of the bag, to be pulled over the head while in bed. The two halves of a shelter tent should be buttoned together and erected as a tent over the bag to shed water in wet weather, and used in dusty weather to wrap the overcoat, which could then be carried in the bag when rolled.

In packing, the toilet articles and extra clothing are placed in the pockets, the pillow flap pushed inside, quilts, blouse and trousers folded and laid inside, the canvas flap smoothed down to exclude dust, the overcoat, wrapped in the shelter halves, laid smoothly along the centre, and the bag then rolled snugly, commencing at the head. It should be fastened by two stout straps connected by a third strap, all sewed to the canvas about eighteen inches from the foot. The two short straps are buckled about the roll transversely, the third about it longitudinally to exclude dust and to make a smaller package of it.

Such a bag, containing all the articles enumerated, weighs less than fifty pounds, and three of them can be conveniently loaded on one pack animal or under the seat of an escort wagon. A cot or bed of any kind would require far too great a proportion of the limited baggage allowance to be at all desirable.

In cold climates much greater warmth results from sleeping close to the ground, and with a little practice one soon accustoms his bones (or fat, as the case may be) to the ground, which is never so hard nor so cold as is commonly supposed. General Wolseley recommends scraping the ground to form a hollow for the hips, and in warm weather or rain, raising the bed on twigs, branches, or hay, if such material can be obtained. I have slept comfortably in a bag of this kind in Arizona an average of ten nights each month for a year, entirely without cot or tent. Increased warmth may be obtained in severe weather by wearing a clean, dry pair of woollen socks and a fur cap or silk travelling cap, and by the use of overcoat, blouse, trousers and shelter-halves as additional bedding. Thus all of an officer's clothing, bedding and tentage actually needed in a campaign of a year may be carried in this compact roll.

For economy of baggage as well as of mess accounts, it will be found advisable for three or more officers to mess together, preferably those of the same company or battalion. English offi-

cers are allowed but twenty pounds for cooking utensils for each troop or company, or for any three officers. Each officer carries two tin plates, one cup, knife, fork, spoon and pepper and salt box in his sleeping-bag; "valise" as they call it. It seems to me better to carry the dishes needed for a mess with its cooking utensils and rations. If these cannot reach camp, or the front in active operations, it is hardly likely the officers' bedding would. And it would be cold comfort indeed to find one's dishes in camp with his bedding, if there were nothing there to eat.

Officers in the field should be willing to do without stoves. I have enjoyed many days' camping when a frying pan and coffee pot were the only utensils, used over a fire on the ground. After a vigorous march one's appetite will render any crude cooking palatable, and the time will doubtless come when we shall be glad to get anything warm without asking over what pattern of stove it was cooked. Even in permanent camps good cooks can serve a sufficiently varied bill of fare with frying pan, broiler, toasting-fork, coffee pot and camp kettle. Bread can be baked in hill-sides or in the Dutch ovens with the troops. Where baggage allowances permit, the Buzzacott ovens now loaned by the Subsistence Department make excellent cookers, and because of their compact telescopic shape are readily and conveniently loaded.

Aluminum cooking utensils and dishes are now made and are certainly the best possible equipment for a mess chest, as they are lighter than china, iron or granite ware, and more easily cleaned than tin. An officer's ration boxes should be renewed as frequently as possible, no heavy chest being carried, but advantage being taken of old flour and coffee sacks and of the boxes in which rations are issued to the troops. The sacks can be thrown away when emptied and the boxes used as kindling. Some kind of chest will be needed for the dishes, cooking utensils, salt, pepper and similar little packages. This chest could be of canvas on wooden frame, of wickerwork or even pine. It should be as small and as light as possible.

Upon emergencies, when cut off from their baggage, unable to burn fires or separated from their proper commands and messes, officers will naturally mess with the nearest company mess, and payment should be made, at a prescribed rate per meal, to that company's fund. General Wolseley says, "All future campaigns must be of short duration, and any officer who cannot

make up his mind to live upon the same fare as his men, had better remain at home with his mother."

Chairs, stools, tables, carpets, rugs, water coolers and other like articles of furniture which I have seen carried on our so-called "practice marches in the enemy's presence," I have not discussed, as I do not believe any one seriously considers such furniture a part of any efficient officer's field baggage.

PERSONAL EQUIPMENT.

Coming now to the especial subject of this paper, I wish to consider what an infantry officer, particularly one who walks, must carry on his person, without which his efficiency would be impaired. According to General Wolseley, "The infantry must be content with less than mounted officers, who can carry extra things on their second chargers." The infantry officer's equipment for the field must be such as to enable him to fulfill all his functions. In their order of relative importance I consider these functions to be:—First, the ability to march and to endure the exposure incident to a campaign, in all climates and under any conditions of weather, even better than his men. If he cannot keep up with the column or endure its hardships, the brightest officer, or the officer with most elaborate armament and equipment is worse than useless; for his very inability or disability robs the command of at least one effective man, left as an attendant upon him. Second: he should be provided with the utensils or equipments needed in leading and instructing his men, reconnoitring the enemy, reporting results to superiors, issuing orders to inferiors, securing and recording information of the country reconnoitred, etc. Third: he requires some slight means of self-defense for emergencies.

First Function.—Following in this discussion this relative order, the first and most essential function of every officer demands that he be equipped with serviceable, healthful clothing, in addition to the sound physique, eager will and soldierly fortitude with which he is presumably endowed. In color the officer's outer clothing should conform generally to that of his men, and it is extremely improbable, even if it were desirable or advisable, that blue will ever be displaced as our national color. Still it may without treason be asked if a light brown or dust color could not be added to the uniform of men and officers alike, for service in the field. The present canvas fatigue suits are too

dark, and only approach a true dust color (the best of all colors for war) when worn out as well as faded by years of fatigue.

A canvas dust-colored blouse, loose-fitting, with four pockets outside and, of course, no braid, rolling instead of standing collar (for who wants a standing collar with a negligé shirt?), light weight in summer and blanket-lined in winter, would prove more durable and less conspicuous than our present dress-parade affair. Trousers of the same color and material, according to season, should be reinforced in the seat, copper-riveted at the pocket-corners, buttons riveted instead of sewed, the trouser legs cut to fit rather snugly about the calves of the legs, so that they need not be creased under the leggins.

Our present drab campaign hat should be lighter in color and less stiff. The sizes usually issued are too small for their marked numbers and for the average demands. Consequently, men tug at the brims to pull them on and thus destroy their shape. The black hat now permitted for officers and sometimes worn, should be proscribed in the field as too conspicuous.

Officers' leggins should be higher than those now issued for the men, as, when the sword is worn, its scabbard insinuates itself inside the leggin and trips the wearer. The laces should be of porpoise leather and the strap of metallic chain. The present strap would not last through one good march across country.

Excellent walking shoes of soft yet waterproof leather, reaching just over the ankles, laced over a double tongue, Waukenphast last, with broad stiff soles, may be purchased even in the West for five or six dollars. These make the best foot-gear obtainable. DeBrack says: "All leather articles which in peace are waxed, in war should be greased"; this to economize brushes, prolong the life of leather and prevent injury by moisture.

Gloves should be of a dull brown or gray color, certainly not white, of a thickness suitable to the climate and season, from lisle thread to fur gauntlets.

For an overcoat good in wet as well as cold weather, the present brown canvas blanket-lined coat cannot be excelled in material. It is, however, too long for walking with comfort, and the same fault can be found with our officer's overcoat, as its tails flap against and get between the legs and retard them. There is no reason why this coat could not be made shorter for infantry, reaching just below the hips, the blanket-lined canvas trousers advocated above being ample protection for the legs. This coat should have

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three or four outside pockets, to carry the utensils mentioned below, and a collar broad enough to protect the ears when turned up. The fur caps and gauntlets now issued to the men are excellent for the winter use of officers. The men's overshoes might be lighter, and should have a leather sole under the rubber, for greater durability and to avoid too much elasticity in marching. In some climates and seasons even German socks will be needed by the officers.

In warm weather a netting undershirt, soft flannel negligé shirt, cotton drawers loosely fitting the calves of the legs, and thin woolen socks, will afford the greatest comfort. In winter the undershirts now issued to the men, drawers of the same material or of flannel closely fitting, and the present issue woolen socks, will be found excellent. In extremely cold weather silk underwear under a chamois skin suit will give the greatest warmth.

The propriety of wearing suspenders of any kind, I think, very doubtful. They transfer the weight of the trousers and all that trouser pockets contain to the shoulders, but at the same time their pressure upon the chest interferes with respiration, and in hot weather prevents the circulation of air under the shirts and the prompt evaporation of perspiration. Leggins serve in a measure to hold up the trousers and a tight waist-band with stout clasp in front will do the rest. With some men slanting shoulders render suspenders a constant annoyance ; with others the accumulation of fat about the hip bones renders it difficult to keep up the trousers by even a tight band; and with a few a corpulent aldermanic front makes some support of the trousers from the shoulders indispensable. The average man will, I think, march better without suspenders.

DeBrack recommends that an officer wear next to his skin a belt of soft leather or linen for use as a purse. This seems like satire to us, who are rarely troubled with money in peace or in war.

Each officer, besides what he wears, should have in his sleeping bag an extra blouse, trousers, shoes, slippers or moccasins for camp wear, gloves, fur cap and gauntlets, silk skull cap, one netting and two woolen undershirts, one cotton and two woolen underdrawers, one negligé shirt, one light and two heavy pairs of socks, one suit of silk underclothing, one chamois skin suit, two face and one bath towel, several extra shoe and legging laces, handkerchiefs, etc. The extra blouse and trousers should be car-

ried, even in brief campaigns, if possible, as they can be worn in camp while the other suit is drying; and they may be imperatively needed, if those worn are lost or injured.

Second Function.—For the proper fulfillment of his second function an officer requires several utensils, all indispensable. Among these are a pad of blank paper and fountain pen for reports and orders, a pad of drawing paper for sketching, an engineer note book, a prismatic compass, horn protractor (180°), a hard lead pencil and a ruler six inches long with scales marked. Scales can be marked on the cover of the note book and on the pads. An excellent substitute for all the above, excepting the pad and pen for orders and reports, is the cavalry sketching case invented by Colonel Richards, of the British service, and described in the JOURNAL OF THE MILITARY SERVICE INSTITUTION for November, 1891. This is six inches square, has two rollers and a continuous roll of paper; a magnetic compass is sunk into the frame, or other sides of which different scales are marked. A rule, protractor, colored and black pencils and rubber, fit into pockets under the board, and from a pivot in its centre, a strap attaches the board to the left wrist while sketching. It is carried in a leather case over the shoulder or attached to the saddle.

Should such a case not be available, the articles named could be carried in the pockets of the blouse. If the blouse have no pockets, they should be in a pouch over the left shoulder resting on the right hip, or attached to the waist-belt in front of the left hip. In the same pockets or pouch should be a pocket range-finder, the simplest made, and a whistle with as shrill a tone as possible. It is hardly necessary to suggest that every officer needs a reliable watch, if possible with illuminated face, and a water-tight match-safe filled with any matches but our present "Safety" brand.

Every officer should be provided with a field-glass of powerful lens, suspended in a stout leather case over the right shoulder and resting on the left hip. During the varying exigencies of the service each officer is liable to sudden detachment from his command upon patrol, outpost, or advance-guard duty. He may be sent alone and on foot to reconnoitre a locality, where a field-glass by its early discernment of the presence, strength and movements of the enemy, would not only gain more information than could safely be obtained by the naked eye, but would frequently save its wearer from an ambuscade. A good pair of glasses with

case and strap weighs only two pounds eight ounces; a canteen of water four pounds two ounces. Wearing the glasses, I would discard the canteen and wear instead a quart cup of aluminum or tin, attached to a snap-hoop on the waist-belt behind the right hip. If in a country where running water is not frequently passed, an extra canteen of water for the officers should be carried by one of the company musicians.

A large jack-knife with blades strong enough for cutting kindling, and sharp enough for dressing wounds or corns, with cork-screw and with hook for removing stones from animals' feet is useful, though not indispensable.

Each officer should have a reliable map of the country visited, and should collect and study railroad maps and time-tables, newspapers, and any reports of the resources of places within the theatre of operations.

After naming a multitude of equipments, General Wolseley says an officer should "carry in his head" even more, viz., to recognize trees and vegetable productions at a distance, to know the length of his pace, of his foot, arm and hand, the height of his eye, waist and knee, capacity of his drinking cup, and generally all statistics possible of the opposing forces.

DeBrack recommends a goatskin bottle of brandy and a pipe and tobacco. He cites many arguments in favor of smoking in the field, and concludes: "Therefore, whatever Aristotle and his learned cabal may say, smoke and make your troopers smoke." I believe most of our officers agree with him, in practice if not in theory, as to the occasional usefulness of these so-called vices.

The waist-belt should be of soft leather, doubled, fitting the waist closely and worn outside the blouse excepting in hot weather. The great millenium promised when our belts were placed under our blouses, has not materialized. However, the equipment, herein recommended can be attached to the belt, whether over or under the blouse.

Third Function.—To quote once more from Wolseley's Pocket Book: "Officers of all ranks and of all branches of the service should have a central-fire revolver carrying the regulation pistol ammunition." This I think necessary for the officer's third function, viz., self-defense. On detached service, outpost, patrol, reconnoitring and even police-guard duty or escorting prisoners, the presence of a revolver, even in its holster, may be of inestimable value. It would certainly prove of as much use in leading

troops to the attack as a sword, and of far greater use in close personal combat in the *melée* which inevitably follows the clash of opposing lines. As it is only to be used in emergencies and when unavoidable, no more ammunition need be carried than the six rounds in its chambers.

The revolver should be worn in a "cowboy" holster on the waist-belt in front of the right hip, the muzzle pointing to the front, the handle to the rear. A flap should pass over the breech and fasten on a stud. This is safer than the present regulation position, as, in drawing pistol from the holster, even in haste, its muzzle points from its holder and towards his opponent all the time; while our regulation "draw pistol" requires that the muzzle, as it leaves the holster behind the right hip, be pointed at the holder's right breast just as it passes under his shoulder. In these days of quick shooting with double-action arms, every precaution should be taken, not only to fire the first shot, but also to send that shot anywhere but into one's own body. Our service revolver should produce shock even at the expense of penetration and accuracy. The latest pattern—Colts navy .38-calibre—possesses the latter, but not the former. A .50-calibre short barrel, double-action six-shooter, sufficiently accurate to hit a man at fifty yards, is all an officer or even a trooper requires.

The Sword.—I believe I have mentioned all that I consider the indispensable items of an infantry officer's equipment. I have not forgotten the sword. It is with most of us the first thing remembered, yet the last thing needed. The sword has so long indicated rank and authority, indeed even knighthood or nobility, that it seems iconoclastic to advocate its retirement to the museum, to join there the pike, battle-axe and armor of ages past and gone. Yet it is now simply a badge of office and is no longer seriously considered a weapon.

Section 1628 of the Revised Statutes prescribes a spontoon, or half-pike, as a weapon for officers of the militia. When that law was enacted, it would have been vain to criticise such an obsolete equipment. Since then the world has moved, and an officer's brain more than his brawn determines his merit. His influence over men is acquired by the existence of superior intelligence and training, not by challenges to personal combat in front of hostile armies. Whatever may be said in favor of *l'arme blanche* for mounted troops, I am now discussing simply the personal equipment of an officer on foot, and in this limited sphere the only ar-

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guments I have heard advanced in favor of the retention of the sword are: its historical recognition as the weapon of a gentleman and the badge of an officer, and its present usefulness as a pointer or indicator at drill.

Opposed to its retention are its weight (including knot, slings and scabbard, two pounds twelve ounces, the same weight to an ounce as the regulation.38 calibre revolver and holster), its awkward shape, and the tendency of the scabbard to get into the leggin or between the legs and trip the wearer. Again, its bright steel and the brighter nickel of the scabbard, by reflecting the sunlight may betray the presence of its wearer while on detached service where secrecy is an object. It would be embarrassing, to say the least, while leading a bayonet charge, to describe a somersault over sage brush, or bend one's scabbard double between the legs; and think of the effect upon one's line! I have seen just such inglorious accidents at extended order drill frequently, and have been the victim more than once. For similar reasons cavalrymen advocate leaving the sabre with the saddle, using only the carbine when dismounted to fight on foot. Colonel Trench, in his book on "Cavalry in Modern War," says: "With regard to the disposal of the men's swords when acting dismounted, Von Schmidt, in his 'Instructions for Cavalry,' remarks as follows: '*As the sword is a great hindrance to the dismounted man in broken ground*, it should be unbuckled and hung on the saddle by the part of the waist-belt between the two slings.'"

A revolver in a holster is compact in shape; weighs no more than the sword; will not inconvenience the officer while manœuvring over rough ground, scaling walls, jumping streams and ditches, or crawling through brush and grass as a scout; does not reflect light and betray its wearer; and can be used fully as well as the sword, on drill or in action, as an indicator or to lead and encourage the men. In personal combat it would, of course, far surpass the frail knitting needle with which we are now armed (?).

If our traditions and sentiment are too strong to discard the sword altogether, I would retain it only for ceremonies, leaving it at home during drills and detached service—certainly dropping it in war.

This proposition to drop the sword is so radical a suggestion of change, and as I believe of reform, that it may not be out of place to recall the history of this honored relic of more chivalrous times. Swords of wood and stone have been found in collections

of ancient savage weapons. Weapons more like swords and less like clubs have been found from the earliest ages of which we have any record, among all peoples who understand the use of metals.

In Assyrian monuments and Etruscan tombs, and by Dr. Schliemann, at Mycenæ, straight and leaf-shaped bronze swords have been found. The Romans used a short, straight bronze sword for thrusting, the Greeks a leaf-shaped blade for cutting with a downward blow. At first the sword was simply a weapon of offense, the shield or armor affording defense; a skillful defense by swordsmanship is peculiar to modern civilization. Historically, the Romans first made use of the point, while their adversaries relied upon cuts wielded by brute strength, and had not the skill to ward off the Romans' points.

Asiatic races still treat the sword merely as a cutting weapon, their blades being, therefore, sharp and curved, to present an oblique and highly acute-angled section of the blade to the victim's flesh. Closely allied to this type is the yataghan, a sword common to the Mohammedan world, slightly curved for slashing, and pointed, though imperfectly, for thrusting. This sword, imported from Africa by way of France, became the sword-bayonet common for a generation in European armies, a modification of which is to be adopted for our new rifle.

In the middle ages swords, notably those carried by the Scots, were so heavy that they had to be wielded by two hands. Edward III. had one seven feet long, weighing eighteen pounds, which was carried by an attendant.

In the days of bronze short swords, and even later with curved blades and scimetars, no guard protected the hand. The basket hilt is characteristic of the time when armor was dropped and the swordsman's skill with his weapon relied upon for defense. Slowly the broad, almost pointless, Roman sword was lightened, tapered and lengthened, and the guard and hilt reduced. St. Lewis, of France, anticipated Napoleon in his advocacy of the use of thrusts. Fencing became an art in the sixteenth century when the early Roman preference for pointing was rediscovered. The reduction of blades reached a climax in the Spanish and Italian rapiers, which could cut but were chiefly used for thrusting. In the eighteenth century, the use of the edge having been abandoned in fencing, the two-edged rapier blade gave way to the bayonet-shaped duelling sword of to-day, the principal change since then being the simplification of the guard.

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Damascus blades received their name and fame when curved and highly sharpened blades were the aim of all. Even during the craze for Ferrara and Toledo blades, a stouter and broader pattern was used for military purposes; gradually this gave way to a single-edged form or broad sword, which in time, through contagion from the East, acquired the slight curvature now characteristic of our cavalry sabre, which does not altogether prevent the use of the point.

While our infantry sword owes its shape to the demands of duellists and comes indirectly from the Roman short-sword, the cavalry sabre is a revival of the Asiatic scimetar, with a species of which cavalry were armed in the Napoleonic wars. Having such widely differing origins and histories, the undisputed usefulness of the sabre is no argument for the retention of the sword.

Gunpowder is rapidly knocking out the idols of warfare as warfare was when none but those personally brave and strong and skillful dared enter mortal combat. The grand old days of Cœur-de-Lion, Saladin and Saint Lewis are no longer here. The hardness and elasticity of a Toledo or an Andrea Ferrara, and the high temper of a Damascus, are alike useless against a modern hail of bullets fired in a cowardly manner from distant cover. Why then retain a weapon whose very presence is an unhappy reminder of our degeneration in personal strength, personal skill and personal courage?

The above is but the expression of one man's opinion; and that man one of slight experience. Doubtless other articles of an officer's equipment will be thought necessary by those who have had more experience, and some of those I suggest will be deemed useless. Whatever is ascertained to be indispensable should, I think, become a uniform equipment by order as well as by custom. At present our officers have no written guide for their equipment for the field. Each man's outfit depends upon his own whim, and is more likely to include DeBrack's pipe and flask than a field-glass and sketching case; while an officer's bedding varies from the saddle-blanket of an ambitious youngster to the feather bed and wire mattress of some gouty veteran.

We are more closely watched than we realize by the National Guard. For their proper edification and for the instruction of the host of volunteer officers to be commissioned at the outbreak of war, I maintain and I believe no one can deny that War Department orders should specify with minute detail the equipment of all officers for the field.

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Comment and Criticism.

(The remarks under this head have, generally, been invited by the Publication Committee, which desires that, as far as practicable, these "Comments" should appear under authors' names.)

I.

"The Military Hand Litter."

Lieut.-Col. Chas. R. Greenleaf, Deputy Surg. Gen., U. S. A.

THIS article and one by the same writer, on Hospital Organization, in a previous number of the JOURNAL, evidences a thoroughness of study into the conditions that are essential to efficiency in the Medical Department during war service, that is to be hoped may be followed by other members of our corps.

In times of peace, demonstrations of the efficiency of hospital administration or of the utility of medical and surgical materials and methods are quite practicable in civil or in large military hospitals, but as to war materials, methods and administration, such demonstrations are almost impracticable, and progress in this direction must be on theoretical lines drawn largely from the experiences of the past.

Major Hoff has been exceptionally fortunate in his personal experience with this kind of service both in Indian campaigns, on practice marches and in organizing and commanding one of our companies of the hospital corps; his views and opinions are therefore entitled to great consideration.

My criticism of the regulation litter is on its weight, which is in my opinion greater than necessary, due probably to the iron pole piece of the leg; this will doubtless be avoided when the present pole piece is discarded in the adoption of a new pole. I do not agree with Major Hoff in the necessity for attached slings, believing that the present sling will be more useful because it *can* be detached if desired; but I am free to confess myself, as one of those who has forgotten the experience of the war in this particular, and is unable to say to what extent if any, slings were used at that time; my opinion is therefore a theoretical one.

It is quite natural and eminently proper that the younger men of our corps should look to their elder and more experienced colleagues for opinions on suggested improvements in war materials and methods, and it is equally proper that we should determine whether our opinions are worth the giving. Did the war of the Rebellion teach us any lessons and if so have they been remembered? Major Hoff tells us of the result of his inquiries about the use of slings with litters. How many medical officers whose terms of service antedate 1865, can tell their juniors what distance litter bearers were able to carry wounded men without relief? whether two or four bearers were required for a litter? what special organization and methods of discipline were found necessary in field or general hospitals? How many would care voluntarily to relate their experiences in administrative failure (due to a lack of previous military training) during 1861-62?

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The great lesson of the war to the medical officer was on the necessity for his military training; he should have learned that the discipline of the company must go with the soldier to the hospital; that efficiency on the field was impossible without a knowledge of military methods; that the go-as-you-please ways of the civilian must give place to the orderly, methodical promptness and obedience of the soldier, and that no matter how able he might be as a surgeon, no matter how profound as a pathologist, no matter how skilful as a diagnostician, he was, without administrative training, helpless as a child in the presence of the wounded of a battle-field.

The passage of time has dulled the memory of many of our older men who, felicitating themselves on the honors paid to their department by a grateful country and by an appreciative world for their achievements during the later days of the war, forget the deplorable shortcomings of its earlier days. Are those shortcomings to be repeated by the rising generation in the coming war? Certainly yes, unless advantage is taken of peace times to cultivate the military spirit and to so perfect its details that in time of need, action in the right direction shall be intuitive and hesitation or incompetence be unknown.

It is a grave mistake to assume that there is an incompatibility between these studies and those that are purely professional; on the contrary they go hand in hand, each being essential to the other in making a complete equipment for the specialty chosen by the medical man who enters the army. The military martinet and the professional specialist are equally out of place, but the all-around well-trained man is the typical and will be the successful army medical officer.

From all that we can learn through the studies of experts on the effects of modern fire-arms, a high order of administrative skill, and a thorough knowledge of military methods will be required to care for the large numbers of wounded that the battle fields of the future will furnish, and it is hardly possible to pay too great attention to the means of preparation for this work.

Our comrades of the National Guard are already actively in this field, and by their zeal and enthusiasm bid fair to outstrip us in our own specialty; their field equipment of medical and surgical material furnished the model on which our present outfit was based; in some of the States the organization of their hospital corps is superior to ours, and some of their blank forms for record work are models which we might adopt with profit.

The Hon. Mr. Reed during the recent debate in the House of Representatives on the Army Appropriation bill, upon the proposed reduction in the personnel of the Medical Department, pithily and truthfully epitomized the requirements in this particular for the medical service as follows: "You do not want merely doctors, but you want army doctors. You want to have men who are not only educated in medicine, but trained in army discipline."

In what better way can our men be "trained" than by careful study and conscientious practice of subjects, a glimpse of which has been given them in the two articles by Major Hoff?

Major V. Havard, Surgeon U. S. Army.

Major Hoff's excellent paper on "The Military Hand Litter," gives a clear and concise view of what has been done in that field in Europe as well as in this country, and correctly states the principles upon which the hand litter should be constructed.

Concerning these principles I am in entire accord with Major Hoff. They have been slowly evolved, as the natural outcome of experience and the best thought of military surgeons, and may now be safely accepted until the march of time and the

actual test of warfare show what further changes are desirable. They may be briefly formulated as follows:

1. Only one pattern of litter for all purposes, for the field and the ambulance wagon.

2. It should close and open quickly and easily, so that it may always be carried closed (that is in its most portable shape) and only opened near the patient.

3. The handles should be fixed and immovable, that is they must simply be the ends of the poles.

4. It should have legs, and these should be fixed, and so shaped as to slide easily upon the floor of the ambulance wagon.

5. Lightness, simplicity of construction and strength are essential qualities which must be combined in such manner as to insure the best practicable result.

6. It must be as short and narrow as the comfort of patient and bearers admits of.

7. Shoulder slings are indispensable.

8. When not in use it should not only be closed but also secured by cross-straps.

9. Both ends should be alike and interchangeable, a permanent head-rest or pillow being unnecessary.

The Medical Department of the United States Army may justly take pride in the fact that our regulation litter embodies these principles to a more complete extent than that of any other country, and is doubtless the best ever yet constructed here or abroad. It is not yet perfect but its defects are venial and some of them easily remediable; thus the cast-iron legs are too heavy and complex and should be replaced by a simple loop of strap iron; the cross straps should be above the poles (immediately beneath the canvas) and not on a level with, and in the way of, the braces; a small handle should be placed near the jointed middle of the braces to enable the bearer to work these with greater ease, quickness and safety. On these improvements, Major Hoff and myself are substantially in agreement.

Our litter weighs 24 pounds with slings; although lighter than any European military litter, it seems somewhat heavier than it ought to be. I think that one or two pounds might be safely removed, but any further reduction of weight appears impossible without endangering its strength; such reduction will only be practicable by changing the material of the poles, for instance, making them of an aluminum alloy or using slender ash poles reinforced with aluminum bands. I have tried slender poles reinforced with steel bands but without success. Bamboo poles, on account of their great elasticity and the difficulty of properly securing the legs and braces, are inadmissible.

At the late meeting of the Association of Military Surgeons in Washington, several litters were exhibited whose principal merit was great lightness; as this was obtained by leaving the legs out and using rigid traverses instead of jointed braces, therefore at the expense of other more necessary requirements, such litters cannot be approved of.

If all authorities agree as to the necessity of slings, there is diversity of opinion as to the best method of using them. Major Hoff contends that they should be secured to the litter, forming an integral part thereof, so that wherever the litter may go or in whichever way it is used the slings are always found with it. In our revision of the drill regulations for the hospital corps I assented to this method, then believing that it combined more advantages with less disadvantages than any other. Since, however, after further experimentation, I have come to think that the "Individual Sling," that is, a sling issued to each bearer as part of his equipment and for his own

exclusive personal use, is a better solution of the question. The litter is thus lightened 2 pounds and the "manual" much simplified. The individual sling being once adjusted to the size of the bearer, so as to give him the best help, needs no further readjustment, while the fixed sling must be shortened or lengthened every time posts are changed. Whenever the litter is lowered, both ends of the individual sling are thrust under the belt, on the left of the belt plate, so as to be out of the way of the hospital corps pouch. A longitudinal slit 2 or 3 inches long, in the centre of the sling, passed over a button sewed under the collar of the blouse or shirt, permits a slight side-to-side motion to the sling while preventing it from slipping over the collar, neck and head of the bearer, thus keeping it smoothly lying in position; this will be recognized a device of great value, for without it the off numbers (1 and 4) must adjust the slings over the shoulders of the bearers every time the litter is lifted; as these numbers will not always be present or available in the field, the slings would often press irksomely upon the neck and be more objectionable than useful. It is needless to say that such device of slit and button is impracticable with fixed slings.

This question of the best method of using slings is a troublesome one, about which we obtain no light from European experience, but well worth the attention of our military surgeons.

II.

"The Management of a Post Hospital."

Lieut.-Col. A. A. Woodhull, Deputy Surg. Gen. U. S. A.

MY opinion in regard to the proper time for sick call, which I have been asked to express, is that in garrison it should be early in the morning, on the march after the halt for the day.

Surgeon's call, or sick call, has a double office. First, to enable the company and post commanders to know how many and what men are for duty, and secondly to arrange conveniently for the care of those who are sick. From a military point of view, to avoid confusion the ineffective men should be selected from the others before the morning reports and details are prepared. And the smaller the command the more important it is to make this selection, for the fewer substitutes there are. The captain and the colonel, that is to say the first sergeant and the sergeant-major, should know before they begin the day's military work upon whom, or at least upon how many, they may depend for guard, for fatigue, for other contingencies, as well as for drill and parade. As long as it is the custom for all military details to be prepared in the morning, I think the medical officer's official judgment should be rendered before the work for the day is thus laid out. Personally I have always followed this method, and I think to the comfort and advantage of all concerned. At one post at my request the field music would sound sick call before leaving the ground at reveille. I found it no more inconvenient to rise at reveille than it was for a company officer, and that necessary but frequently annoying duty was put out of the way without trouble before the men's breakfast hour. Of course with a large sick report that could not be done. Having roughly eliminated the sick from the well, their more discriminating examination and special care can be conducted later if preferred. Should the command be a very large one several medical officers may hold sick call simultaneously. This is not the custom, but there is no reason why it should not be done.

The objections to afternoon sick call in garrison are:

It not only throws work upon all grades of the Medical Department, from privates up, at an unusual hour, but it inverts a world-wide custom by practically beginning the day's work at the wrong end of the day.

Men sick enough for hospital care should be examined, transferred, and settled in

their new quarters before the day is far advanced. Practically the men of the hospital corps are constantly on duty, and it is hardly fair to throw extra work upon them when the ordinary day's labor has passed. This quite irrespective of the convenience of medical officers.

But a more serious question than the derangement of details by men actually or claiming to be sick, is the possible hardship to the men themselves if required to wait all day for attention. As always happens, emergency cases will be cared for whenever the emergency arises, but the majority of garrison cases are not those of emergency. It curiously happens that, usually, indisposition is most clearly defined when it appears after the repose that night offers. A man who feels ill in the morning is apt to remain so all the day, and unless discipline is very exact, and even then at the expense of much inconvenience, a deferred sick call will mean a string of men presented with the company sick report at irregular intervals all day long. This is subversive of all system and is productive of much inconvenience to every one concerned. The disadvantages of a late sick call, so far as the sick are concerned, increase with the size of the command. In a miniature garrison, of the type now happily decreasing, it is of much less consequence in that respect, although liable to derange the details more. But as the principle is the main point, what is done on a small scale should be adaptable to a large command. Should the military day be made to commence in the evening, as occasionally happens from exigencies of particular duty, such as a target season, sick call may properly be transferred with the other formalities. But that is exceptional, and while bringing the military relations in accord does not alter what has already been said in regard to the sick. On the march all the conditions are changed, and as in the earlier Mosaic records the evening and the morning make the day.

The above remarks take no account of the personal convenience of the medical officer, which need not be considered if it runs counter to the public interest. But ordinarily he would not prefer to have stated duty set for the end of the day.

The exception of an island post, influenced by the hours of communication with the mainland, does not disprove the rule.

Akin to this is the physiological disadvantage of evening guard-mount. It is much more trying to men to begin a tour of twenty-four hours' guard at the end of a day than after a night's rest. The disturbed sleep of the night on guard tells severely in the next day's duty.

III.

Wire Gun Construction.*

Lieut. G. N. Whistler, 5th U. S. Artillery, Engineer for the Brown Segmental Wire Gun.

"DOCTORS will differ."—We are therefore not surprised to find that Captains Moch and Birnie have widely divergent views upon the subject of the value of wire guns.

Captain Gaston Moch, of the French Artillery, an authority recognized throughout the entire world, tells us that in his opinion the *wire gun is the gun of the future.*

Whereas, Captain Birnie, United States Ordnance Department, an authority equally well recognized throughout the world, informs us that in his opinion the *wire gun* is the *gun of the past.*

According to Captain Moch, we must look to the system of wire construction in

*See "A General Review of Existing Artillery" by Capt. Gaston Moch, in JOURNALS 68 and 69; and "Artillery: its Progress and Present Position," a review, by Capt. Rogers Birnie, in JOURNAL No. 68.

order to increase the efficiency of modern high power guns. In his opinion the question of cost does not appear to enter. The wire gun he considers to have a decided advantage over the steel "built-up" gun, and that by this means of construction, it is possible to materially increase the powder pressure, and thus secure a greater amount of efficiency. He maintains that it requires less thickness of wire than it does of solid steel to obtain the same strength, and that the wire gun can be readily so constructed as to give a greater muzzle energy per ton of weight than can be obtained from the steel "built-up" system.

Captain Birnie on the contrary looks upon the system of wire gun construction as "out of date, that their place in the process of development belongs to the period when steel could only be safely and properly made in relatively small pieces." In other words that wire guns are a back number.

He also states that it is not possible to gain efficiency by wire winding, and that the wire envelope must be of the same thickness as the hoop envelope, to obtain the same strength in the gun and thus to admit of the same pressures, and consequently that the two guns have equal efficiency.

We thus perceive that these two great authorities have reached diametrically opposite conclusions upon this subject. I presume that it will be maintained that it is natural that Captain Moch should favor the wire gun, and equally natural that Captain Birnie should favor the steel "built-up" gun; and I very much fear that if I dip my oar into this controversy, there will be some unjust individual who will insinuate that possibly Whistler might be slightly prejudiced in favor of the wire gun.

That these two great authorities, Birnie and Moch, should differ as to the value of wire guns, can be readily understood; but when we find Captain Moch making the statement that "the resistance to bursting will always demand a less weight of wire than of compact metal, whatever may be the progress made in metallurgy;" and also find Captain Birnie making the diametrically opposite statement that, "giving the same tube, limited as it should be to the same safe limits of extension or compression in the two cases, it follows that the wire wound envelope must be of the same thickness as the hoop envelope, to make the strength of the wire gun equal to that of the hoop gun"; the situation becomes puzzling. Both of these gentlemen have developed mathematical methods for the determination of this very question, and consequently when we find them coming to diametrically opposite conclusions, the natural tendency would be to create some doubt in the minds of the ordinary layman as to the value of their mathematical deductions. I think however that their opposite views may be explained.

Captain Moch has spent many years in the development of the wire wound gun system, and in interpreting his formulæ, he necessarily makes his interpretations apply to the wire gun construction. Captain Birnie on the contrary has given an equal amount of thought to the development of the hoop system of construction, and consequently in interpreting his formulæ he naturally applied them to the hoop system, and has failed to see that while his formulæ may be readily applied to wire gun construction, in such application a somewhat different interpretation must be used from that used in their application to the hoop system; this may be readily shown as follows:

The following formula is applicable both to the hoop and wire system of gun construction.

$$P_o = \frac{3\ (R_1^2 - R_0^2)\quad (\theta + C)}{(4\ R_1^2 + 2\ R_0^2) - 6\ R_1^2 \times I.} \qquad (1)$$

Considering the moduli of wire and the tube the same, we have

$$I = \frac{R_0^2\ (R_n^2 - R_1^2)}{R_1^2\ (R_n^2 - R_0^2)} \qquad (2)$$

Substituting this value of l in equation (1), and reducing, we obtain the following:

$$P_o = \frac{3\,(R_n^2 - R_0^2)\,(\theta + C)}{4\,R_n^2 + 2\,R_0^2} \qquad (3)$$

R_o = Radius of bore.

R_1 = Exterior radius of inner tube.

R_n = Exterior of radius of any portion of (n) cylinders, of the exterior radius of a wire wound system.

θ = Elastic limit of inner tube under tensile stress.

C = Compression per square inch at surface of bore, system at rest.

P_o = The pressure in bore of gun which will stretch the metal at surface of bore of inner tube beyond its elastic limit of extension.

In constructing a hooped gun so as to obtain the greatest amount of efficiency from the metal used, each hoop is shrunk upon the system in such a manner that under interior radial pressure, the inner surfaces of the several hoops shall reach *their elastic limit for extension* at the same instant. Therefore Captain Birnie calls P_o the tangential resistance of the system, and considers it, as he should, the maximum powder pressure which can be safely used in the gun. For the hooped guns this interpretation of P_o is manifestly the correct one, as whenever the powder pressure in the bore of the gun exceeds this value, an exceedingly thin layer of metal at the interior surfaces of each of the (n) cylinders, will be carried beyond its elastic limit; this will change the entire condition of the tension of the system, and will reduce the value of C; although it may at the same time increase the elastic limit of the metal of each of these thin layers. It therefore follows that whenever the powder pressure exceeds this value of P_o, the tangential resistance of the gun is decreased, and therefore the gun weakened. P_o is therefore the limit of safe powder pressure, and never if possible should be exceeded in practice in a hooped gun. In modern guns the custom is to place the maximum powder pressure at about 75 % of the tangential resistance.

Captain Birnie considers that precisely the same interpretation should be given to the value of P_o in wire guns; and when he states that the wire envelope must be of the same thickness as the hoop envelope, he is simply making the mathematical statement that if in equation (3), we make R_o, R_n, C and the elastic limit of the inner tube all constant, that P_o will be the same for both guns; this is of course true: that is, the pressure which will carry the inner tube beyond its elastic limit for extension will be the same for both guns. However in the steel "built-up" gun P_o is the maximum limit of a safe powder pressure, but in the wire gun P_o is *not* the maximum limit of a safe power pressure; this is readily manifest from the following considerations:

The elastic strength of the wire so far exceeds that of the inner tube of solid metal in the wire gun, that the pressure which will stretch the metal at the surface of the bore beyond its elastic limit, will not utilize two-thirds of the elastic limit of the wire; and consequently under a powder pressure of P_o pounds per square inch, the only portion of the metal of a wire gun which will be stretched beyond its elastic limit is a very thin layer at the surface of the bore. In fact in a wire gun a powder pressure which exceeds the value of P_o would slightly increase the tangential resistance of the system, instead of decreasing it. From these considerations it is readily seen that in two guns (one hooped and the other wire-wound, having the same liner, both compressed within the limits prescribed by Captain Birnie), the wire gun will necessarily be the stronger of the two, and the more efficient; as we can always with perfect safety use a powder pressure of P_o pounds per square inch in the wire gun, knowing that even should we exceed this pressure, we do not pass the safe limit of the gun; whereas in steel "built-up" guns, the powder pressure must be fixed at such an amount that it shall never exceed this value of P_o pounds per square inch

I do not wish to be understood as maintaining that modern steel "built-up" guns cannot withstand powder pressures with reasonable safety beyond the value of their tangential resistance; but I do claim that the continuous use of such pressures in steel "built-up" guns will reduce their tangential resistance; whereas in wire guns, we may continually exceed this value of P_o within reasonable limits, without lowering the tangential resistance of the guns.

COMPRESSION OF THE BORE.

Captain Birnie is very emphatic in his condemnation of over compression of the bore; by which it is to be understood, the producing at the surface of the bore of a compression which exceeds the elastic limit for compression of the inner tube. Captain Birnie speaks of this as a "serious error," "a departure from principles," and furthermore speaks of "a safe limit of extension or compression," intimating that a compression beyond the elastic limit of the metal is unsafe and opposed to sound principles of gun construction. I cannot agree with Captain Birnie in this matter, as I believe it not only to be perfectly safe, but I also believe it to be sound in principle.

The effect produced by over compression of the bore is two-fold in its character. We must first consider the effect upon the metal of the inner tube due to this compression; and second, whether such over compression will in any way affect the tension in the outer envelope; if so, whether it will reduce the value of P_o, and consequently whether it is possible by means of over compression, to increase the tangential resistance of the system.

Concerning the effect of over compression upon the elastic character of the metal in the inner tube, it is perfectly clear to my mind that the effect will be to increase rather than to decrease its elastic strength. It is a known fact that if by cold work we carry any portion of a piece of metal beyond its elastic limit, either for extension or compression, we thereby increase the elastic limit of the metal so overstrained, producing what is known as a condition of special elasticity. In the over-compression of a hollow cylinder in the ordinary process of gun construction, it is true that only a portion of it will probably be carried beyond its elastic limit, and consequently only a portion of the metal will be given an increased degree of elasticity; if however, we consider the methods of the application of the stress, we will perceive that the change in the elastic condition will be gradual, and that the molecular stress set up thereby, will act in such a direction as to tend to increase rather than decrease the resistance of the tube, considered as a whole.

I am aware that it has been claimed, that cold work acting in one direction only, while it increases the elastic limit in that particular direction, decreases the elastic limit in the opposite direction, that is, that the range of elasticity remains constant. This may have been found true in free specimens of metal, where the stress is applied in one direction only; but I am satisfied that the principle is not generally true. I have, for example, before me a piece of wire, drawn from a billet of steel, the range of elasticity of which did not exceed 100,000 pounds per square inch. The present elastic limit for extension of this piece of wire is 250,000 pounds per square inch; therefore, if the theory that the range of elasticity is not increased by cold work is true, it would necessarily follow that this piece of wire must have a negative elastic limit for compression, which of course, is not so. The same thing may be shown in the case of cold-rolled steel, and my own experiments in that direction have convinced me that in cold-working steel, either by compression or extension, you do unquestionably increase the elastic range, except in that portion of the metal near the edges, which, not being supported, tends to bulge and crack.

I think it is probably true that a small piece of metal, such as is used in speci-

mens, if compressed in one direction only, might be so much injured upon its outer surface that the total elastic strength of the specimen for extension would be found to be the same, or even slightly decreased; if however, the outer surface be turned off, and the specimen be re-measured before the stress of extension is applied, I am satisfied that it will be found that the elastic limit for extension per square inch has increased in the same ratio as the elastic limit for compression.

The experiments made by Mr. Brown and myself in the construction of two segmental wire cylinders, together with a considerable number of experiments touching upon the effect produced by cold-rolling, have satisfied me that the over-compression of a cylinder by shrinkage or winding does not injure the metal. Of course it must be remembered that when we increase the elastic limit of a piece of steel we reduce its ductility, and consequently, in determining the amount of over-compression of the metal which may be safely used in the gun, we must necessarily take into consideration the loss of ductility produced by such compression.

In considering the second point we must remember when we apply a force to a piece of steel, either of extension or compression, that within the elastic limit the strains are proportional to the stresses; at the instant we pass the elastic limit there is a sudden yield of the metal, and after passing this point the metal yields more uniformly; but the strains are not proportional to the stresses in any case after passing the elastic limit. Now in winding a cylinder with wire, so long as the inner tube is not compressed beyond its elastic limit, we can compute readily the condition of the tension within the system; as soon, however, as the inner tube passes its elastic limit, and the sudden yield occurs, the tension in the envelope is slacked off, and we have absolutely no means of determining accurately the conditions of the tension in the system.

Here we have the chief objection to over-compression,—we cannot possibly determine theoretically the tangential resistance of the gun. I am, however, thoroughly satisfied that the error which would result from a reasonable over-compression of the inner tube has been entirely exaggerated. I am satisfied that the compression of a free specimen in one direction only, cannot be used as a criterion whereby we can determine what will occur when we compress the cylinder radially. In the first place, I am satisfied, could the same be accurately measured, it would be found that the elastic limit for compression of a tube radially is very much greater than the elastic limit of a specimen compressed in one direction only (by elastic limit I mean the range within which the strains are proportional to the stress). I am also satisfied that while it is undoubtedly true, that after passing the elastic limit of the metal at the surface of the bore the strains at that particular point will not be quite proportional to the stress, that the distortion of the cylinder itself will be so nearly proportional to the stress applied by the envelope, that the slacking off of the wire will be entirely immaterial; and when we remember that the tangential resistance of the system (that is P_0) is not a safe limit of the powder pressure, as it is in the steel "built-up" gun; it is manifestly clear that the slacking off of the wire in consequence of the over-compression of the inner tube may be totally ignored in computing the strength of the gun.

The space which it is proper to use in a paper of this kind, intended merely as a comment, does not admit of a full discussion of this exceedingly important question; but I am thoroughly satisfied that so far as the wire gun system is concerned, Captain Birnie is entirely in error as to the danger of the over-compression at the surface of the bore.

In this connection I would respectfully call attention especially to the fact that in the Brown segmental wire system of gun construction, the wire is wound upon the core which sustains the tension of winding. The core is constructed of longitudinal

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segments, and this comminution of the parts renders it possible to use economically the highest grade of steel; thus in the 5-inch experimental Brown segmental wire gun, the segments were constructed of Carpenter's crucible chrome steel; and we are thus enabled to obtain for this core a metal having a very high elastic limit, and in consequence of the smallness of the parts we can readily produce a high degree of special elasticity; the elastic limit of the segments of the 5-inch gun was over 100,000 pounds per square inch, with an elongation of 14 per cent. in two inch specimens.

As already stated, this core sustains the tension of winding, and as the metal from which it is constructed will have a very much higher elastic limit than the metal of the inner tube or liner, it is not at all necessary to compress the core up to its elastic limit, in order to over-compress the liner to any amount which will probably ever be used in practice. The core having been wound and carefully bored to the proper dimensions, it is shrunk over the liner; thus producing at the surface of the bore any over-compression that may be desired without straining any portion of the core beyond its elastic limit, and consequently without slacking off in any way the tension of the winding. It is thus manifest that in the Brown segmental system of wire gun construction, it is perfectly practicable to obtain the advantages of over-compression, and at the same time avoid all disadvantages connected therewith.

It is Mr. Brown's idea to produce, if possible, such a compression at the surface of the bore, that the metal of the liner will not be carried through zero under ordinary service powder pressures; and consequently the elastic limit for extension of the liner will not be utilized, save for the high pressures of battering charges required for penetration of armor.

HIGH PRESSURES IN SEA-COAST AND NAVY GUNS.

Captain Moch advocates increasing the efficiency of sea-coast and navy guns by such improvements in gun construction as will enable us to use very much higher maximum pressures. I entirely coincide with the captain upon this point, although I am fully aware that this view of the matter is not *as yet* accepted by the officers of the Ordnance Department of the army. Personally I am not informed as to the view of the navy upon this subject. The general opinion of the officers of the Ordnance Department (so far as I have been enabled to gather the same), is that there is no practicable value in the proposed excessive pressures in modern guns, and they maintain that the scoring produced by such pressures reduces the life of the gun so rapidly, that there is practically no reason for constructing a gun capable of sustaining them. This view of the subject is undoubtedly due to the fact that for years past the value of a gun has been determined by its endurance, and the idea of constructing a short-lived gun, simply because it can be used for a few rounds to produce a very intense effect, is *as yet* entirely opposed to their notions of gun construction.

The modern sea-coast and navy gun is preëminently a battering machine, intended mainly for the purpose of penetrating armor. It is true that such a gun must be available for bombarding purposes, for firing at unarmored vessels, and for other uses than that of simply penetrating armor; for such purposes, however, it must be remembered that even the modern pressures of from sixteen to eighteen tons are entirely unnecessary; a pressure of from fourteen to fifteen tons would be ample for all service work save that of penetrating armor, and any modern high power gun would certainly have sufficient endurance to stand the usual endurance test with such comparatively low pressures. The great and most important work of a gun is to penetrate armor, and every gun intended for such purposes should be capable within its battering range to penetrate any armor afloat, penetrable by its class.

In no war would any sea-coast gun with reasonable probability be required to fire more than fifty such battering rounds, and no navy gun would be required to fire over

one hundred such battering rounds. The criterion of battering efficiency of a gun, should therefore be determined as follows: A sea-coast gun should be capable of firing fifty rounds at battering pressures, and a navy gun one hundred rounds at battering pressures, without becoming by scoring, so inaccurate, that a vessel could not be hit within their respective battering ranges. I would fix the battering range of a sea-coast gun as within somewhere about three miles, depending upon the calibre of the gun; and for a navy gun fifteen hundred yards.

The results of the test of the 5-inch Brown segmental wire gun at Sandy Hook, have to my mind demonstrated beyond question that we can construct a 10-inch Brown segmental wire gun capable of sustaining, without in any way decreasing its tangential resistance, a pressure of 60,000 pounds per square inch. With such a gun and with a proper charge of Leonard smokeless powder, we could obtain a muzzle velocity of 3200 feet per second. This would give us sufficient energy at three miles range to penetrate any armor afloat. It is undoubtedly true that one hundred rounds with 60,000 pounds pressure per square inch, fired from this gun, would score the gun so terribly as to render it inaccurate for target-practice work. By this I mean the fine accuracy generally looked for in target practice. But it would be sufficiently accurate to insure hitting the armored portion of a vessel at 1500 yards range, and after fifty rounds, would, in my opinion, be amply accurate for battering service at a range of three miles.

Now I respectfully maintain that such a gun considered as a battering machine is of far more value than one which, while it could sustain five hundred rounds with ordinary pressures, would be unable to perform the penetrating work corresponding to a pressure of 60,000 pounds per square inch.

LINING TUBE.

This brings up the question of the lining tube, which in my opinion will play a very important part in the guns of the future. If my opinion and views upon the subject are sound, the fifty or one hundred battering rounds at such enormous pressures, while they will score the gun and render it unserviceable by want of accuracy, will but slightly, if at all, affect its tangential resistance. If then, we can, after the war or even during the war, remove the scored liner and introduce a new one, our gun will practically be as good as new. It may be that the severe racking which it has received will have reduced materially its service endurance; it is manifest, however, that with its new liner it will be able to stand the same number of battering rounds a second time. The true endurance of a gun for battering pressures, could therefore be determined by firing one hundred rounds, renewing the liner, again firing one hundred rounds, renewing the liner, and continuing this process until the gun has been rendered absolutely unserviceable.

One object of the experiments in the test of the 5-inch Brown segmental wire gun, was to test a thin liner. This gun was lined for seventy-five inches from the bottom of the bore with a liner which at the breech was about one-half an inch thick, and at the front end three-eighths of an inch thick. The liner was turned upon a taper and pulled into the gun, producing a compression at the surface of the bore of 80,000 pounds per square inch. The liner cracked at the front end of the chamber on the 216th round. On the 172d round,—being the 161st of the official test,—the chamber was found to have increased by scoring, about or near the place where the crack occurred, .067 of an inch in diameter, thus showing that at that point the thickness of the liner did not exceed one-quarter of an inch. Nevertheless this liner had withstood 216 rounds, of which number sixty were with service pressures of over 37,000 pounds per square inch, and seventy with battering pressures of 50,000 pounds per square inch and over. Of these battering pressures seven were over 60,000 pounds per square inch, four over

70,000 pounds, one over 75,000 pounds, and one gave the enormous pressure of 82,950 pounds per square inch. When we consider the enormous strain to which this liner was subjected,—which we acknowledge was too thin for the purpose for which it was intended,—it must be clear to any one that it is entirely practical to insert a comparatively thin liner into a gun, ample to withstand these enormous pressures.

In conclusion I would urge that Captain Moch's views upon the subject of wire gun construction and high pressures in modern guns are not only theoretically sound, but that the experiments with the 5-inch Brown segmental wire gun have demonstrated the truth of his theories, and the practicability of constructing a wire gun capable of doing the work that he deems necessary. We do not claim that we have not made some mistakes in constructing our first experimental gun; nor do we claim that the details of the system may not be improved; but we do claim that by the Brown segmental system of wire gun construction, it is possible to construct a high power gun with a battering efficiency greater than it is possible to obtain from any hooped gun, whatever may be the further increase in the metallurgic art of steel making.

IV.

"Should the Fixed Coast Defenses of the United States be transferred to the Navy?"

Lieutenant E. M. Weaver, R. Q. M., 2d U. S. Artillery.

IN the March number of the MILITARY SERVICE INSTITUTION JOURNAL, Colonel Hains of the Corps of Engineers propounds anew the question: "Should the fixed defenses of the United States be transferred to the Navy?"

His answer to the question is very interesting and voices the sympathies of officers of artillery.

It seems however to the writer that Colonel Hains has to some extent gone astray in his premises, the arguments based on them and the conclusions drawn.

Almost the entire argument presented by Colonel Hains is based on the assumption that it will be necessary to create a new force if the functions of coast defense be entrusted to the Navy Department; that if the transfer be made, the mobility of the naval fleet will be impaired, and that the glorious prowess of our naval fleet as exhibited in past wars will disappear from the pages of history.

While there are reasons why the coast defenses should remain with the War Department, it is important that we should face the question squarely and that nothing should rest on doubtful assertion.

If we shall be forced to present this question for trial before the Committees of Congress, no advantage will be gained by resting the case on specious arguments.

I conceive that the coast artillery occupies an intermediate position in the controversy which has arisen between officers of the Army and Navy in regard to this matter. Not neutral, for, as already said, the sympathies of the artillery by association rest with the army. Nevertheless the artillery is able to look at the question in a more impartial way than either of the disputants, for the reason that whether the defense of the coast be entrusted to the Navy Department or whether it remain with War Department, it is probable the present authorized force of coast artillery troops would be charged with the performance of the artillery work; if transferred to the navy, ordinary principles of business economy suggest that the force now provided for this work should be transferred with the work itself. Under either department the coast artillery would perform its duties faithfully. The direct connection of the coast artillery with the subject and the responsibility it must carry under any determination of the question, entitles one to give expression to views as seen from this standpoint.

It may be said that this position does not exhibit the proper degree of loyalty to the army side of the question. The answer is, that there is such a thing as loyalty to what one conceives to be the needs of the country which takes precedence over that springing from professional and personal relations.

Colonel Hains very aptly compares coast forts and the naval fleet to permanent interior fortresses and an army in the field (p. 236). This, as an illustration, hardly supports the Colonel's contention that the forts should be under the War Department and the fleet under the Navy Department. If the illustration be applied, it would place the field army under one department and the fortress troops under another. The world of confusion which would result from such a dual control between a fortress and army may fairly be taken to point out the evils of dual control in the defense of a harbor.

In regard to Colonel Hains' idea that if the coast defenses be transferred to the control of the Navy Department the mobility and aggressive powers of the fleet would be impaired, it is believed he has not separated clearly in his mind the fleet itself—the war-ships—from the Navy Department--the administrative mechanism provided for the control of all features of naval defense. Just as it is possible under the War Department to have under the same control the field army proper and other corps of special troops organized for special functions, like the engineer troops and the hospital corps, so it is perfectly feasible to have different divisions under the Navy Department without in any way interfering with the perfect freedom of the mobile fleet. As a matter of fact, there is the marine battalion ; it is not made up of blue jackets ; it has its own methods of administration, entirely distinct from the navy proper, and its own hierarchy of officers ; yet there has been no difficulty of control, nor any impairment of the mobility of the navy. If a special corps were organized strictly for coast defense and administered throughout distinct from the line of the navy, it cannot be said that the naval fleet would be in any way unfavorably affected. If anything, it would be more free to act than ever before ; the fleet would be entirely relieved of coast defense ; all coast defense vessels would be associated with the coast forts as auxiliary forces and the whole would be fought by one officer, giving a strong united defense.

Colonel Hains says "it is a perfectly hopeless task to undertake to train men for equally efficient service in forts on shore and in ships at sea" (p. 237). But if it is not proposed to do this there can be no such question.

The Colonel argues that because a coast fort will have to provide for defense against an attack from the land, side coast defense must pertain to the army. All authorities agree that the days of landing armies on a hostile coast for invasion are at an end. The only force which would be likely to attack the land front would be the relatively small number of blue jackets and marines which could be spared from the usual complement of the battle-ships, and if the fort can fight these afloat it ought to be able to fight them ashore. If reinforcements were needed, however, they could be readily furnished by the National Guard, or volunteers from the adjacent district, and a properly developed system of coast defense would provide for coast defense guardsmen among the state troops. The naval reserve battalions which have been formed in New York, Rhode Island, and Massachusetts marks the line suggested.

In case the defense of the coast were placed under the Navy Department, it is not apparent why it would be necessary to create a corps of military engineers to construct and keep in repair coast forts as claimed by Colonel Hains. If the present force of military engineers in the employ of the United States can do this work under the War Department, why could it not do it when transferred to the Navy Department? The officers of the engineer corps are detailed to perform civil work in connection with rivers and harbors, why can they not be detailed to work for the Navy Department, or

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indeed engineering work of any nature whatever for the United States? It should not be forgotten that we all are servants of the United States before we are members of any association.

Another weak argument of the Colonel is, that the transfer should not be made because the gun carriages used on shore are different from those used on board-ship (p. 245). But neither he nor any one else would assert that the Naval Ordnance Bureau could not supply land carriages if required to do so. Or, indeed, the supply could come from civil firms; or, again, why should not any supply department of the Government—even the Army Ordnance Department—supply material to the Navy Department if the interests of the United States seemed to require it? A Government Supply Department should be able to supply any branch of either service if necessary.

As to the guns, the Naval Ordnance Bureau was for years the pioneer in constructing high-power guns in this country. No bureau or department of the Government has shown more energy or greater ability or has been more progressive than the Naval Ordnance Bureau. It is to be assumed, as a matter of course, that, if necessary, this bureau could supply any ordnance material that might be required for coast-defense.

We come now to the really controlling question of this whole discussion, namely, *unity of control.* Colonel Hains thinks that "unity of control so far as concerns the United States can only be had at the cost of diminished efficiency," because "our navy being small in number of ships should have the utmost freedom of action" (p. 250). But it has been and will be further shown herein that unity of control and perfect freedom of action of the naval fleet are perfectly compatible. Colonel Hains' idea of the relation existing and which should continue to exist between the army and the navy in regard to coast-defense is thus enunciated: "In the coast-defense system of the United States both the army and the navy have their important parts to play, and to do so without friction it is only necessary that a clear and unmistakable line should separate their mutual duties and responsibilities. The navy has sole charge and control of everything pertaining to the active defense—the army the less desirable, but equally important part, the passive defense. The line is clear as the services are now organized. With a clear understanding of the duties of each, there is no reason why they may not successfully coöperate."

It is pertinent to inquire how can the line be clear separating the two services, with a misunderstanding and conflicting claims as to duties and responsibilities between the services? This entire discussion finds its origin precisely in these conflicting claims, and it is impossible to brush them aside by asserting they do not exist and have not existed.

For example: Colonel Hains says the navy should have "sole charge and control of everything pertaining to the active defense." Now the active defense will be the operations of the naval fleet of battle-ships and cruisers on the high seas. What shall become of the harbor defense craft, built solely for work along the shore and incapable of going on the high seas? These are, in truth, merely auxiliary forces, auxiliary to the fort defense, just as cavalry and field artillery are auxiliary to the infantry on the battle-field. They are properly a part of the *passive* defense. Will Colonel Hains turn them over to the army? Undoubtedly he has the same right to claim them as the navy proper—the line of the navy—has to claim the forts as pertaining to the water defense—the active defense. As a matter of fact there is not, never has been and never will be an agreement as to the division of duties between the army and navy in connection with coast defense, for the reason that under a dual administration it is impossible. One has only to read the Rebellion records covering the operations on the western rivers, on the James River, before Fort Fisher, and especially at Charleston Harbor, to get an idea of the difficulty of coöperation. No fairer or more favorable test could be made than that at Charleston, and yet it seemed utterly impossible for

the naval and army commanders to work in unison. Special efforts were made to bring about unity of action between the land and sea forces, but each time there was a miscarriage due to misunderstanding or failure of arrangements. If this could happen on the offensive when all action could be carefully prearranged, how great confusion would result on the defensive with the initiative with our opponents! One can readily imagine the interference of plans and methods associated with a dual defense of a harbor; as already pointed out, Colonel Hains' own comparison of the defense of a harbor with the defense of an interior fortress aptly applies, and there is the same argument for unity of control in both cases. The criminations and recriminations between the army and navy during the Civil War and in writing since (see even Colonel Hains' article, reference to an "incompetent navy" (p. 247), have amounted to a national disgrace. The strongest argument in favor of unity of control is, perhaps, that it will remove the opportunity for future disputes, and, as many think, future disaster.

It must be admitted by all candid minds that coast defense begins at the shore and extends out some few miles to sea, and that all government forces within the limit, whether primary or auxiliary, assigned to the defense of a harbor, should be under the direct and immediate command of an experienced technical expert—one who by a lifetime of study and training had mastered both the water and land features of coast defense. The defense of a harbor against a naval attack is one of the fundamental units of the science of war. It is as essential, for example, in the defense of New York and Brooklyn from the bombardment of a hostile fleet between Sandy Hook and Coney Island, as unity of control was essential to Gen. Hancock on the battle-field of Gettysburg; and just as Gen. Hancock claimed there the right to control the artillery fire independent of the dual claim set up by Gen. Hunt, chief of artillery of the Army of the Potomac, so should the commanding officer of coast defense control *all* fire and forces, primary and auxiliary, in harbor defense.

A general officer of the army would not be competent to command all the forces in such a defense, by reason of his lack of technical training. A flag-officer of the line of the navy is equally debarred for the same reason. Only an officer of a Coast Defense Corps would be competent—one who had for years made a special study of the conditions of this very attack, is familiar with all the offensive and defensive powers of the hostile naval fleet, and knows the best manner to utilize, in combination, all the forces of the Government assigned to the work.

This, then, is the weak point in Colonel Hains' argument. He does not realize that coast defense is a distinct classification of work, independent of the army and equally independent of the navy. Every argument he has employed against the transfer of the coast defenses to the navy applies with equal force against its remaining under army control, and precisely for the reason that it belongs strictly to neither, but stands apart alone between the two.

By providing a separate Coast Defense Corps, the mobile navy and the mobile army each is liberated completely from all responsibility of shore defense. The passive defense is entirely divorced from the active operations, whether land or sea. Both the navy and the army are free to act as aggressively as may be necessary. Unity of control is secured without diminished efficiency.

The only real advantage the army has in this discussion is that of *possession*. There are some batteries of artillery, a part of the regular artillery force of the army, which happen, at the present time, to be dismounted, and are assigned to coast artillery work, because chiefly of the expense associated with mounted artillery, and because there is no special demand for a larger infantry force than that of the regular infantry regiments. It is the first time however in the history of the country that these conditions have obtained for so long a time, and it is the first time there has ever been any

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real sea-coast artillery work. During the War of 1812, the Mexican War, and the Civil War, this artillery was used as field artillery. During the Florida War and other Indian wars it was used chiefly as infantry. Only on one or two occasions has it been permitted to take up coast-artillery work. Most of the time it has been employed as infantry pure and simple * To such an extent had this promiscuous use of the arm as infantry been carried, that artillery spirit and love of and interest in artillery work have all but vanished. It thus appears that while these artillery troops at present happen to be giving attention to coast-artillery work, it cannot be said that the field of coast defense is occupied. It is because many naval officers see this neglect of the subject of coast-defense, and know from their visits abroad the requirements of the field and importance of the duties, that they are prompted to do something toward occupying the field; if the army wont, the navy will. Artillery officers have for many years realized these facts and conditions. They have often attempted to secure an organization better suited to the requirements of coast defense; but, without a chief and without means to reach in an effective way the ear of Congress, their efforts have always failed.

It is quite discouraging, if not disheartening just at this time, to have an engineer officer of Colonel Hains' standing write that "the evils of the existing system of coast defense are more imaginary than real" (p. 250). Officers of artillery think they know of many very real evils associated with the present status of affairs. Colonel Hains endeavors to disconnect the subject from that of artillery organization, but this cannot be done. There can be no system of coast defense, properly so called, until there is a personnel organized to have charge of the work, and no such body exists at the present time. Until there is such a coast-defense corps the navy has a perfect right to consider the field unoccupied, and to reach out for it.

Mr. Outhwaite, chairman of the military committee of the House of Representatives, has recently introduced a bill which is now before a sub-committee for consideration. This bill provides for a corps of coast artillery; a chief of artillery who, under the Secretary of War and the General of the army, shall command the artillery and supervise its instruction and discipline and determine and regulate its armament. While this is not all that is necessary, it is in the right direction and the good of the country requires this much. The artillery claims it as its just dues and a proper basis of organization. But, for some reason, it is understood there are influences at work against the bill. We are ignorant of the nature of these influences and are powerless to combat them.

If the staff corps which are interested in this question will unite with us cordially and help us to secure the passage of the Outhwaite bill in such a way as to preserve the features named above, there will very soon be a cessation of naval claims. If the bill is killed, it will be only natural if the efforts for transfer to the navy be renewed from year to year by the navy.

No amount of argument can disprove the fact that an independent coast defense corps could be as well administered by the Navy Department as by the War Department, and it is foolish for us to shut our eyes to this fact or to attempt to direct the attention of others aside.

It should be clearly understood that past associations and existing ties urge artillerymen to prefer army relationship, but if it shall appear that we are unable to secure in the army what we feel assured is the proper organization for coast defense work, we are only doing what we conceive to be a service to our country if we reach out our hand to clasp that of the navy which is extended in good fellowship toward us.

* For instance see Lieut. Simpson's History of the Second Artillery, in No. 64 of this JOURNAL.

V.

"Infantry Footwear."

Captain Frederick Von Schrader, Q. M. Dept., U. S. A.

LIEUT. PHISTER'S graduating essay at the U. S. Infantry and Cavalry School on the subject of Infantry Footwear, published in the last number of the magazine, will be read with interest by all those whose duty it is to look after the welfare of the soldier and provide him with improved equipments. The importance he attaches to the subject cannot be underrated and his argument shows that he has given it much thought. Lieut. Phister can congratulate himself that many of the improvements he has suggested in his article have been adopted in the new calfskin shoe, recently issued to the army after a series of trials extending over many months.

The substitution of heavy calfskin for cowhide in the uppers will undoubtedly result in greater satisfaction to the soldier, in that the shoe will be more comfortable, especially around the ankle. Sightliness or style must always be a factor of more or less weight in the cut of all military garments, boots and shoes not excepted. People will not "abandon ideas as to style," and the uniforms of the world are constantly undergoing changes to meet these new conditions.

In recent years American tanned calfskins have improved in quality, and their cost has now made it possible to make the change from cow to calf skin. So long as Congress makes appropriations for the maintenance of the army, "the paltry consideration as to price" must unfortunately prevail in the purchase of every article.

As to weight, the shoe suggested by Lieut. Phister would be heavier than the shoe now issued. Sole and upper leather are the same, but he would make his "a half-boot shape," presumably after the old bootee pattern, and, in addition, place a metal plate at toe and heel. A metal plate at toe and heel would take up much of the wear, but they would be found extremely unsatisfactory, for the reason that the metal soon becomes smooth and highly polished, causing the wearer much discomfort by frequently slipping. Except as a measure of economy they should never be introduced. Germany's infantry are shod with iron upon a heavy boot, purely from motives of economy.

The campaign shoe cannot be improved upon as to pattern for a marching shoe, for it possesses many advantages over any other, and few disadvantages. We see practically the same shoe in the market for both men and women, advertised as "Bluchers," "Blucherettes," etc., and extolled for their comfort as walking shoes. The absence of any seam to hurt the foot, and the ready adjustment with the laces of the shoe over instep and around ankle, make the campaign pattern particularly desirable for marching. Those who have had experience know how much the feet swell on a long march, and how grateful any adjustment of this kind is to the foot. Lighter uppers than those made of calfskins, weighing four and a half pounds each (Lieut. Phister recommends 5 or 6 pounds each) could hardly be tried until experience demonstrates that a lighter upper is more desirable.

With regard to the tanning of leather, Lieut. Phister has been wrongly informed. The subject of oak and hemlock bark as materials for tanning was very thoroughly discussed in an article by Capt. John F. Rodgers, M.S.K., U.S.A., published in the report of the Quartermaster General U.S.A. for 1877. The question of hot or cold tanning does not enter, but the relative merits of each substance are given. Oak tanned leather is given the preference, and army shoes have always been made of this material ever since. Dry and slaughter hides do however make a difference in leather. That produced from dry or flint hides is much tougher and less flexible than from green or slaughter hides, and is consequently better adapted for the soles of shoes.

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Shoe uppers should be made of leather tanned from slaughter hides, for the reason that they make a more pliable leather and here pliability is needed. The army specifications call for the soles to be made of "dry" hides, while the uppers are to be made of "green slaughter" hides.

Much thought has been given to the fit or sizes of the new shoe, and with the introduction of another width to the three heretofore in use, no trouble should be experienced in fitting the ordinary foot, provided the same pains are taken as described for "Recruit Ferguson." Soldiers if left to themselves in this matter will almost invariably select a pair of shoes that are too short for their "weighted foot." This is especially too apt to be the case from the fact that there are no half sizes to select from. The introduction of half sizes of proportionate widths would unquestionably facilitate obtaining a better and more comely fit, but the danger of tight shoes would not be lessened without a careful supervision.

No advantage can accrue by having the grain of the calfskin on the outside, and wearing it on the foot as nature designed it for the animal. So-called English grain leather, of which some hunting boots are made, is no better for being finished in the grain; but being so finished, it is thought to be more in keeping with the style of a heavy boot. For this reason cavalry boot legs are so made. The objection to grain leather is that it soon becomes hard by exposure to the weather unless kept thoroughly oiled. Oiling will improve the wear of all shoe leather.

Taking the vital elements of Lieut. Phister's infantry shoe, it will be found that the specifications of the new calfskin shoe, issued some months ago to the army, conform in general to his recommendations, and, like his, the new shoe is of medium weight calfskin, hand sewed, with a heavy oak-tanned sole projecting slightly beyond the upper, with a flat shank and a low broad heel, with a smooth insole and great width of sole at the ball.

VI.

"The Post Mess."

Lieutenant M. F. Steele, 8th U. S. Cavalry.

SO much has already been written about the General Mess, and published in the JOURNAL, that it would seem time to drop the subject. Yet there has been a vast deal of repetition. The same argument pro and con has been adduced over and over again; and, furthermore, most of the articles, so far, have come from the pens of officers who had had no personal experience in the handling of a general mess. I managed—or *mis*managed, if you please,—a general mess of four troops of cavalry, for a twelvemonth. This experience I offer as apology for any notions I may have to submit on the subject.

The general messes now in existence in our service were all set up on *theory;* and I fear *fact*, however strong and opposed, will never be strong enough to pull them down. However hard it is to introduce anything new in the army, it is even harder to get rid of it after it is proved a nuisance.

Economy is the cornerstone of the general mess—in theory. Leaving out the question of mess-halls, cooking ranges, etc., the argument upon which the general mess has been established is like this: If two men mess together, each will live more cheaply than either could live alone. If ten men mess together the expense per man will be still further reduced. If two companies mess together, they will be able to fare better on a given ration than one company alone. Ten companies combining will better the fare proportionately.

Lieutenant Clarke, in his article in the last JOURNAL, says it has been demonstrated by "practical application" "that in a general mess the 'savings' are proportionately

larger per company than they are in small messes." If by "small messes" he means messes of single companies, I would answer that my own experience with a general mess did not bear out his statement.

Yet this theory of a "saving" by geometrical progression, has taken such a hold upon us, that some of us with a mathematical turn of mind, have almost come to believe that if the number of men messing together be increased to infinity, the ration may be reduced to zero.

Now, in truth, this whole matter of improving the fare by increasing the number of men in the mess, hinges upon the question of wastage. If ten men mess together the proportionate wastage ought to be less than it would be if each one messed by himself—the "saving" would be greater. But there is a limit to this principle. The Saviour knew the limit nineteen centuries ago, when he said to his disciples, "Make them sit down by *fifties* in a company" [Luke ix. 14]. I believe the limit is passed when we make the number of men in the mess greater than a company. It is passed the moment we reach that condition in which the individual ceases to take a personal interest in saving. This condition is reached when the company is merged into the general mess. Soldiers have a sort of personal pride and interest in their company, that they have in nothing else. Each man regards his company as his own; but do what you may, you cannot instill into him a like feeling toward any other institution of the service—not even toward his regiment; surely not toward a general mess. The men appear to have no personal interest in saving; in aiding in any way to make the mess a success. Every man's hand is against it; every enlisted man abominates it.

Nearly all men, even soldiers, have individualities of taste. What is nectar to one is wormwood to another. The smaller the number of men to feed, therefore, the less the difficulty in hitting upon a dish that will please all. This difference of taste is not confined to substance, but extends to methods of cooking and preparation. When the number of men to feed runs up into the hundreds, and the variety of foods is limited to the articles of the soldier's ration, eked out by a few purchases from the "savings" and the Exchange profits, the difficulty of suiting all, or even a large proportion, is so great as to be a hopeless impossibility.

Not only this, but there are scores of dishes that can be prepared and made palatable for a small mess—a single troop—which are out of the question in a four-company mess—at least such was the case with the meagre facilities for cooking in the kitchen of the general mess I suffered and labored for. If it were a question of "flap-jacks," of which soldiers are wont to be fond, the cooks would have to begin baking them two hours before the meal, in order to get enough ahead to begin on. Counting six to a man,—a small allowance, especially if butter and molasses can be supplied, and there be a contingent of colored troopers in the mess,—a mess of 280 men will require 1620 "flap-jacks." Fancy the tough immasticability, the leathery indigestability, the unpalatable frigidity of the first hundred or two of these baked and set aside!

Fried steak and onions, and all other victuals which have to be cooked in small quantities at a time, suffer in the same way. With a single company, by having an extra man or two volunteer to help the cooks—and this is not unusual—such viands can be served fresh and hot.

Some men like potato salad, others would rather suffer trial by court-martial than to see "sour potatoes," as they contemptuously call it, come on their table. The same of many other dishes. Now, in the mess of a single company the tastes of the mildly cranky men are known, and something else will usually be prepared by the cooks for them, when such dishes are on the bill of fare. Any man can go to his company kitchen and ask the cooks what they are going to have for the next meal. There is not

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the formality and exclusiveness which must be maintained about the kitchen of the combined mess. "What you gittin' for supper, Cheffy?" old Mulligan will ask as he passes the kitchen door on his way with the fatigue party. "Oatmeal!" "Aw, I don't like chicken feed; fry me a piece of bacon, won't you?" "All right!" And bacon Mulligan gets. At the general mess, he would have to eat oatmeal or content himself with bread and coffee.

And every troop is a little clan. Every man thinks Jones of his troop is the only good cook in the "outfit." If Peters of K troop is chief cook, the men of all the other troops growl about his cooking. His hash is sour, or his beef is raw, or his coffee is too strong, or something else is wrong. The same is true of the non-commissioned officer detailed as steward. Furthermore, this latter is an expense unknown to the company mess. In the latter the first sergeant or some good warrant officer runs the mess; and runs it well and without extra pay for his pains. In the general mess the steward must be paid out of the mess fund, and even with the extra pay, I found it a hard place to get suitable non-commissioned officers for. They don't want the "job" at any price. Nearly every non-commissioned officer can criticise the management of the incumbent steward, but not one is willing to take his place. Indeed, it is a very disagreeable position. I had no trouble in getting a good steward for the Exchange. This duty is agreeable. Good non-commissioned officers are glad to have it, take a pride in it, and do it well. With the general mess it is entirely different. I had as steward of the Exchange as good a non-commissioned officer as I have seen in the army—he was active, intelligent, systematic, tireless and a splendid manager. I asked the post commander to let me take him in the mess. Here he was a dead failure—no better than the rest. Wherein the difference? In the Exchange all hands are paid. The cooks and attendants, therefore, do their work properly in order to keep their places. The steward does not constantly have to watch them to keep them from smashing china, and prod them to make them do their work right. In the mess only the cooks are paid extra. The dining-room men work only to get through. They slight wherever they can do so without getting caught. The steward must constantly watch them, or make excuses for them and for himself when the mess-officer, or the post-surgeon, or the officer of the day, or the commanding officer comes round to inspect. There will be a table not well wiped off, or a plate left damp, or a knife not clean, or a fork with dirt between the tines, or a thousand and one other trifling things to find fault with. In the troop mess, the captain can punish these little neglects, by refusing a night-pass to the responsible man, or by denying him the use of his horse for pleasure riding. Not so the mess-officer. His only resort is to prefer charges; and not the least of his innumerable petty annoyances is the preferring of charges for offenses so trivial that it requires a page and a half of specification to make them visible to the summary court.

It is supposed that there is a great saving of labor, as well as of provisions, in the general mess. This is doubtful. There must be at least two men from each company to tend the dining-room, wash dishes and tables, set and wait on the tables, and so forth, and to help the cooks pare potatoes, clean fish and the like. How many are required in a company mess? In the matter of cooks, there are more men in a general mess than there is absolute need of; but each company commander insists upon having one man of his company in the kitchen to learn how to cook. And, truly, this appears necessary, in order that the company may always be prepared to do its own cooking in the field.

For purposes of discipline, it would appear that the combined mess, under the direct supervision of the post commander, should be the best. Mess call can be sounded at a fixed hour, assembling five minutes thereafter, and the men, clad in the

prescribed uniform can be fallen in and marched to the mess hall. After they enter, the doors may be closed and guarded by sentinels to prevent any one else from entering. This all is military and as it should be. But cannot a captain, if he will, see that his troop's meals are served with the same regularity? and cannot he require his men to wear their blouses to meals, and so forth? and if he won't, cannot the post commander find a way to make him?

I found to my disappointment and regret that a general mess and post orders cannot teach good manners. Thirteen dollars a month does not pay for elegant table manners. Of course, many soldiers know that their forks are meant to convey the food to their mouths; that their saucers are not furnished to cool their coffee in; that the spoon in the potatoes is there to be used; and that it makes the sugar in the dish lumpy and unsightly to souse into it a spoon wet with coffee; and many of them live up to their knowledge. But those that don't are vastly in the majority. Many would probably be glad to know that these things are not according to the table code of the "Four Hundred." But how to tell them? It is surely too trivial an affair to be the subject of post orders or mess-hall regulations. I, for one, should hate to prefer charges against an old soldier, one perhaps who had received scars in battle and could teach me many things about my trade, for eating with his knife, or picking his teeth with his fork. I have, however, thought that if some of the benevolent societies which have taken the spiritual welfare of the soldier in hand, and whose presidents spend their talent in composing poetic prayers, and their money in printing them on cards to distribute to the army, would put the same amount of talent and money in supplying cards bearing a short, *sensible* code of table manners, they might do some good to the military service. The first step in the path to good morals is good manners. Such cards, if scattered about on the tables of the mess-hall and the reading-room would be read. No doubt they would be laughed at and ridiculed; but, still, they would have their effect. In conclusion, the general mess complicates the matter of the post Exchange; at least it apparently does. Suppose a company having no company fund arrives at a post to take station. The amount assessed against it to buy into the Exchange, is paid by retaining in the Exchange the dividend it would receive had it paid in at the start, until the sum is made up. But suppose there be a general mess at the post which has a mess fund, and that all the profits of the Exchange are turned over to the mess fund. The incoming company can pay neither the assessment levied against it for the Exchange, nor the amount assessed against it for the mess. Yet it will have to be admitted to the general mess, and will thereby become a partner in the Exchange, and a beneficiary of its profits, as well as of the mess fund already accumulated before it joined the mess.

Lieut. James W. McAndrew, 21st U. S. Infantry.

There is in our army a large and very conservative element which combats apparently any proposed change in existing army methods, whatever may be the nature of such a change. To this element, whatever is, is best, and much needed reforms often appear as unnecessary and even harmful innovations. The introduction of more modern drill regulations, changes in certain articles of our uniform from antiquated and uncomfortable patterns to those more suitable, the substitution of a modern magazine rifle for the Springfield single-loader, have all met with strong opposition, and it seems there are officers in our service who even doubt the necessity for a modern up-to-date organization for the infantry arm.

Were the governing powers to heed the advice of this conservative element our army would soon fall hopelessly behind the times. Fortunately, perhaps, for us, when changes are to be made they seem to seek but little advice on the subject. We have

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our growl, but the officials at Washington have their way. The changes are made despite opposition, and in a few months we find ourselves wondering why such changes were so long in coming, their advantages are then so obvious.

May not a good deal of the opposition to the general mess system for our troops be due to this conservatism? The post mess is indeed, "so far as applied to the posts where in operation and thus to the line proper of our army," "still in its experimental stage." It has as yet been given scarcely a fair trial, and all the arguments that have been advanced pro and con seem to but make more clear the necessity for such a trial before the system is condemned or finally approved.

Lieutenant Clarke's article on this subject, published in the JOURNAL OF THE MILITARY SERVICE INSTITUTION for May, is interesting reading, but his arguments against the general mess system are scarcely convincing. No doubt the strongest argument on his side of the question is that the system of consolidated messes at the different posts is but a poor preparation for the separate company messes which will have to come in the event of active field service.

Let us examine the four objections to the general mess system that Lieutenant Clarke states are "among the many objections advanced by the enlisted man in support of his opposition to that system."

1st. "That it interferes with comradeship and the close relationship among men only possible at the company mess table." There is surely nothing in the general mess system that prohibits companies from having their own tables, or from being separated from the other companies in the mess hall as much as may be necessary in order to cultivate this "close relationship among men."

2d. "That cooking by the steam process is not so agreeable as the method ordinarily used." It certainly should be possible for the post mess to have the best process for cooking known, and if the process now used is not agreeable, then one should be used that will be found to be agreeable.

3d. "That in a large mess it is not possible to have the variety procurable in a company mess where properly supervised." If Lieutenant Clarke's conclusion that a general mess results in a more economical manipulation of the ration be correct, which conclusion no one will dispute, then the foregoing objection cannot hold good, and the exact opposite must be the case. Where properly supervised it should be possible to give even a greater variety in the general mess than in the company mess; since the resources of the former are greater, and since there is economy in buying and handling any article of food in large quantities.

4th. "That there is danger at times of finding his food not as hot as he would like." This objection, too, it should be possible to overcome by providing in the kitchens the necessary heating apparatus, and detailing enough men to properly handle the food. The reduction in the number of men required for duty as cooks and kitchen police in the general mess, as compared with the aggregate number required for the same duty in the company messes, is but a secondary consideration as compared with the proper handling of the food.

The question of how to make the most of the ration that the government furnishes the soldier is certainly an important one to our army. Many officers whose opinions are well worthy of respect think that the best results can be obtained by the adoption of the general mess system, and for the present at least the authorities at Washington seem to agree with them. If such a system be not the best it is to be hoped that stronger arguments be brought against it than those based upon the results of incomplete trials. To this end Lieutenant Clarke might give us, in addition to the reasons he has already advanced, why this system should not be adopted, and to further support his views, the "other reasons of similar nature that are forthcoming for the asking."

Reprints and Translations.*

VON MOLTKE AS A TEACHER OF TACTICS.

From the Army and Navy Gazette.

WHETHER the combination of qualities by which Moltke won his fame deserves the title of genius, is a question of no practical importance. The great fact, come whence it may, which has impressed the minds of men is his masterly and abiding success. It has already been said, with sufficient frequency, that this success was due to a lifelong study of the science and art of warfare, but it could never have been attained by that alone. The student brought with him to the several great tasks of his life, the power of keen insight, comprehensive grasp, and rapid decision. Conscientiously acting up to his own motto, *Erst wägen, dann wagen* (First weigh, then venture), he exhibited that happy union of boldness and caution which is the most precious gift of a commander. Much light has recently been shed on the character and work of the field marshal, and his campaigns have been carefully observed from various points of view, but nothing has been published approaching his Tactical Problems in interest and value for the military student. This will be easily understood when it is remembered how much his country owed to his far-seeing wisdom as an organizer. To him Prussia is indebted for her system of reserves, her mobilization arrangements, and her strategic network of railways, which permit troops to be quickly concentrated at the bidding of a supreme authority. When, therefore, some critic hazards the assertion that but for the strong reserves ever on the march to reinforce him, or but for the railway lines at his disposal, this or that operation would have failed, the appropriate answer is that the reserves and the railways were his own creation; he had foreseen their necessity, and calculated on the advantages which they would secure. In pursuance of his plans, the railway system has since then been developed, both in the east and in the west, so that whether Germany be menaced from the one side or from the other, her enemy will be promptly confronted. But the element which, perhaps more than any other, contributed to his victories, was the consummate tactical training of his subordinate commanders. To this he had devoted his personal attention for many years. He trained the officers of the general staff with the most assiduous care, and even after the Franco-German War was over he continued to direct their studies, and to give them the benefit of his judgment and experience. It was often remarked, during the progress of the war, that the German superior officers displayed a wonderful intelligence in

* Please address communications concerning reprints, translations and reviews to Lieut. J. C. Bush, editor of this department.

supporting each other, and in carrying out the general design of a great movement. But this was simply the result of the tactical education which, under Moltke, had become so prominent a feature in the Prussian army.

After the death of their chief, it was natural that the officers of the general staff should be anxious to collect and preserve all that had been committed to writing of the lessons to which they had listened. In pursuance of this view, Major Bigge undertook to edit whatever could be found of the field-marshal's problems and solutions, the consequence being that, although the voice of the master is silent, we have a golden treasury of his tactical studies. These may be said to vary in value, but, in the words of their editor, "All of them will, on account of their lucidity and surprising simplicity, ever remain model decisions, and afford, by their pronounced originality, a fountain of suggestion and information." The book thus placed in the hands of the German army is a highly prized possession, and Herr von Donat is to be cordially thanked for bringing it, by his translation, within the reach of every British officer. This he was enabled to do by the kind permission of the general staff. The translator says, in his preface: "It has been my aim to adhere closely to the original, rather than to render it into elegant English, which, although it might have been more readable, would have been a less exact and trustworthy guide for the student." It is, of course, to be expected that there will be some abruptness and disregard of literary grace in a manual dealing with military orders and the enumeration of troops. It should also be borne in mind that many of Count von Moltke's criticisms were addressed, *vivâ voce*, to the officers, and were taken down in shorthand. In these, the conversational manner is, more or less, retained, but his many written solutions are expressed in a clear and decided style, to which the translation does ample justice.

It may be remarked that, taken as a whole, these problems supply an admirable preparation for the actual handling of troops in the field. They also promote the formation of a resolute character by obliging the student to select his line of action with promptitude, and to maintain it with consistency. This involves a habit of mind which it is of the utmost importance that the soldier should cultivate. Another lesson conveyed by the problems is that common sense must be relied on in those situations to which stereotyped rules do not apply. "Strategy," said Moltke, in summing up one of his extempore criticisms, "is the application of common sense to the conduct of war. The difficulty lies in its execution, for we are dependent on an indefinite number of factors, like wind and weather, fogs, wrong reports, etc. If, therefore, theoretical science alone will never lead us to victory, we must nevertheless not entirely disregard it. General von Willisen very truly says: 'It is only a step from knowing to doing, but it is a still greater from not knowing to doing.' The best lessons for the future we draw from our own experience, but as that must always be limited, we must make use of the experience of others by studying military history. Besides which, another means of furthering our education is the working out of such supposed warlike situations as our problems present."

In endeavoring to arrive at some notion of Moltke's teaching as a tactician and strategist, it would be difficult to find a better guide than General

von Verdy du Vernois, formerly Minister of War in Berlin. He lectured so recently as March 7, 1894, to the Berlin Military Society, on "Plans of Operation," illustrating his views by constant reference to Moltke's work. General von Verdy du Vernois expressed regret that it had become common in Germany to speak of a "Moltke system," and to interpret it by the phrase "march separate, fight united." He objected both to the title and to its interpretation, maintaining that the phrase, although often applicable, indicated nothing either new or systematic, and that Moltke himself frequently warned his officers against placing reliance on any system for general use. This view is certainly justified by the field-marshal's own words. The General went on to say that measures had to be adopted in accordance with the actual situation in each case, and that Moltke was so consistent as to style his arrangements "first concentrations" rather than "plans of operation." "The labors of the chief of the general staff, even those of Field-Marshal Count von Moltke," continued the General, "are to be regarded as counsels or proposals, the execution of which is committed to other hands." The field-marshal himself always ascribed the higher merit of a successful action to him who had the responsibility of carrying it out. To depend on a system is empiricism; to prescribe for each individual case as its peculiarities become apparent, is science. As in the practice of medicine so in the conduct of war, the highest professional education and the widest experience are necessary to the attainment of a distinguished place. It may be remarked, by way of digression, that these doctrines of the great military instructor should be duly considered before a ministry of defense is decided upon. Officials intrusted with the duty of advising or directing combined naval and military movements could not, according to Moltke, do more than supply "first concentrations," but even for this purpose they would require to be trained naval and military strategists. And when they had done their best the responsibility of dealing with changing circumstances on active service still would belong to the actual commanders. The latter should be, in all respects, capable of coming to a right decision, and of rendering to each other the most effective support.

Instead of trying to classify the problems more minutely, it may be sufficient to point out that they are largely composed of two classes of operations, one towards the East and the other towards the West, in both of which directions the eyes of German leaders have long been turned with untiring watchfulness. To the former class, for instance, the fiftieth problem belongs, commencing as follows: "On the intelligence that a hostile corps is advancing from Wirballen on Königsberg, the Prussian 1st Army Corps is detached by Lötzen, and charged with preventing the further advance of the enemy and throwing him back, if possible, across the frontier." The solution of this problem, and the field-marshal's further remarks, furnish a good specimen of his style in addressing the student officers of the general staff. He says, that in taking up a flanking position, "we must require that the flank which it presents to the enemy is resting on, or otherwise protected by the ground, by favorable artillery positions, or by the position of the reserve. On perfectly level ground, the enemy would surely not do us the favor of deploying in front of us in order to attack, but

he would advance obliquely against the wing nearest to him and roll up our position. The effect of a flanking position, besides, need not alone depend on keeping the enemy's line of advance under an effective fire, but it can make itself also felt by an offensive movement from the position." These are simple sentences, but they did their share in bringing before the mind of his hearers what the field-marshal called "the general skeleton around which the other measures must arrange themselves." The following is a noticeable passage in the same address:—"According to my opinion, owing to the improvements in fire-arms, the tactical defensive has gained a great advantage over the tactical offensive. We were always offensive, certainly, in the campaign of 1870, and attacked and captured the strongest positions of the enemy; but, gentlemen, with what sacrifices? It appears to me more favorable if the offensive is only assumed after repulsing several attacks of the enemy." These observations were made in 1874. The position selected on this occasion was under cover of the Plickner Berge, near Gumbinnen, and the whole study is well fitted to familiarize the mind of a Prussian officer with the work expected of him in the event of the Russians adopting that line of invasion. The scene of another operation is at Osterode, near the same frontier. It is said: "The key of this position, Hirschberg and Klien Gröben, he (the enemy) will have occupied with infantry, having pushed forward two posts to hear of our advance; he will then deploy when that advance occurs." After criticising the written exercises of some of the officers, the field-marshal warns them against the error of making troops wait for orders, and illustrates it as follows: "The leader of the detachment, for instance, sees that he can easily take Osterwein, but he dare not; or he sees that he can easily penetrate into Hirschberg simultaneously with the enemy, but he dare not, because he is waiting for an order. The right moment is then easily missed. To detached leaders one must give only general instructions by which they can act freely."

There was some humor in the field-marshal's criticism of the papers in which difficulties were obviated by the statement: "I reserve to myself the further orders." "Well, gentlemen," said he, "this is all very well in a disposition; there, one need not give any further explanations and reasons. You can hide your further intentions from your subordinate leaders, but in an examination question you must not withhold from us your further intentions, because you are to be judged by these." In several of the studies the field of operations is familiar to those who have followed the course of the Franco-German War. The sixtieth problem, which is one of these, was set in the final examination of the officers in our own Staff College in 1892; and another (the forty-ninth) is a literally true account of the battle of Mars-la-Tour. Belfort, Mülhausen, and Metz are the centres of interest in the 43d, 44th, 57th and 58th problems. It would, however, be impossible in these cases, or, as a matter of fact, in any of the series, to present the reader with a semblance of the solutions by merely making isolated extracts. All that can be hoped is to present a few faint outlines from which some idea of Moltke's instructional work may be obtained.

It has doubtless been gathered from the foregoing that Moltke required his officers to use their own judgment and common sense, to know their

surrounding country, to act with promptitude, and to accept responsibility; but he demanded more than these. Implicit obedience to a distinct order was just as necessary to the making of a soldier. Some of his remarks on the sixty-second problem, and on the papers by which officers had solved it, teach this lesson. They are as follows: "The division is charged with inflicting a defeat on the enemy if possible. I can imagine that this order was subjected to some criticism at headquarters in Gesecke. They would say: 'We are to make the enemy suffer defeat; the enemy stands in a formidable position behind the river. How are we to set about this? It is our business to march to the Rhine. How far are we to run after him?" The commander-in-chief is responsible for that order, but the division for its execution. The commander-in-chief, surely, may also have had his reasons for issuing that order. It is perhaps very inconvenient for the commander-in-chief to see a hostile division remaining so close to a road which is, perhaps, to be a line of communication. The 60th Regiment is just available; it is handed over to us, and we are desired to provide against the above-mentioned inconvenience by a rapid blow. Willingly or unwillingly, we will have to undertake the business after all. * * * Some gentlemen have proposed a position in the neighborhood of Gesecke; they wish to let the enemy come up and then in turn to become offensive against him. Well, gentlemen, but if he does not come? Shall we report 'we have had the good intention of making the enemy suffer a defeat, but he did not come'? That will not do; that would not be carrying out the order." But examples need not be multiplied. The book will be valued by soldiers as the work of a master whose extraordinary gifts of mind and character, aided by his constant vigilance and labor, have placed him among the greatest commanders of history. Reputations like his, resting on the solid foundation of duty perfectly known and conscientiously performed, are those that remain unshaken as the years roll on.

THE PASSAGE OF RIVERS BY CAVALRY.

From The Saturday Review.

THE importance of cavalry in war, in spite of the strides made of late years by arms of precision, appears likely, if we read the signs of the times correctly, to increase rather than to diminish. The *arme blanche* may possibly not be able to assert its powers on the battle-field itself as in the golden prime of Ziethen and Seydlitz, but it will find other opportunities; and the manner in which it can turn them to account will still influence, though less directly so than hitherto, the issue of campaigns. And the gathering masses of horsemen on the western frontiers of Russia, confronted by growing bodies of Austrian and German *reiterei*, warn us how the next storm on the Continent will first burst on us. The portents are certainly full of encouragement for the enthusiastic *sabreur*, and it is small wonder that he is throwing himself everywhere into the study of his arm with increased and increasing zeal. Mobility being as the breath

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of life to cavalry, it is naturally striving to train itself to be equal to every difficulty which may check its activity. It is seeking, not only to be able to brush aside the irritating opposition which comparatively small bodies of well-posted riflemen may throw in its path, but to overcome the natural obstacles which may impede its free and unhampered progress. Horse artillery, and perhaps machine-guns, lend it aid for one purpose, and it may fight effectively on foot without sacrificing the dash and rapidity on which it will ultimately rely. A small ditch or rivulet, however, has ere now disordered and paralyzed the splendid intrepidity of a Murat. Therefore much attention is being given abroad to training troop-horses to leap such obstacles freely. But an unbridged river may render a well-planned reconnaissance unavailing, if the eager squadrons are to be brought to a standstill by it; and yet, since horses and men can easily learn to swim, such a barrier need never prove quite impassable. Squadrons that are not accustomed to dealing with the difficulties which streams may throw in the way of their unrestricted march are not, in fact, trained as they should be, to be equal to all the exigencies which war may impose upon them. Hence it is that, on the Continent, great attention has of late been given to the passage of rivers by cavalry, and that, especially in Russia, the actual swimming of them has become a very familiar feature of the exercises of regiments and divisions.

Perhaps the memories of the great wars at the commencement of the century have reminded Russian soldiers of the value of such instruction. During the great invasion of their country by Napoleon almost the whole of a squadron of Polish Lancers was drowned at Kovno. In 1808 a similar disaster overtook the Chasseurs à cheval of the Guard when they attempted the passage of the Esla on the 29th of December, and on that occasion General Lefèbvre nearly lost his life. When, again, the bridge across the Elster was prematurely blown up after the battle of Leipzig, hundreds of French mounted men perished in trying to effect their escape through its waters. The gallant Prince Poniatowski was thus drowned, and Marshal Macdonald only escaped a similar fate by great good fortune. Radetski, one of the most brilliant soldiers of the century, owed his early reputation to the skill and courage he displayed in swimming the Sambre during the early wars of the French Republic. Three years later he again swam his horse across the Mincio, and in 1805 he for a third time made himself notorious by swimming a river at the head of a division of hussars, and thus surprising his opponent. The dashing Skobeleff held very advanced ideas as to the capabilities of cavalry in this direction; and, in order to develop the complete powers of the arm, wished to see them undeterred in the presence of obstacles which less carefully trained men might find denying their further progress. It is not, however, to be supposed that he, or any other thoughtful leader, ever entertained visions as to squadrons armed *cap-à-pie* recklessly plunging into rivers, and exhibiting amphibious proclivities totally out of keeping with the received adage as to keeping powder dry. He says:—"I do not admit the possibility of men swimming on their horses in full marching order, except over very small streams with firm bottoms, and I consider that swimming, with small rivers, such as the Sooprasl (105

feet broad), and going on to regular rivers, such as the Danube, Wisla, Amoor, and Syr Daria, is best carried out by the following three methods." He then proceeds to give an account of some experiments which he had carried out a few days previously with three squadrons of Dragoons. Narrow rivers, it seems, might best be crossed if the uniform and equipments of men and horses were ferried over on rafts or small boats, while the men swam their horses across with watering bridles only. The mention of boats or rafts, it will be noted, suggests an element of unreality, for the former are not always at hand, and it takes some time to construct the latter, even when materials are obligingly present, which, it is to be feared, will not always be the case. If such adjuncts cannot be had, it is suggested that a few good swimmers should take a light rope across by means of which an axe or two and a picket-rope may be passed to them. A felled tree or stake will then make the picket-rope fast on the further shore, and it can be drawn taut from the hither bank. By means of it a detachment, who will carry their clothing, rifles, ammunition, and intrenching tools in a bundle round their necks, may make their way over, and take up a position to cover the crossing of the remainder, who in turn effect the passage after the same fashion. Finally, the horses are swum over in squads. A sub-lieutenant of the Russian Life Guards, it may be added, has designed a bag which, on such occasions, ought to be of immense service. It is made of waterproof canvas, weighs only 2½ lbs., and is 4½ ft. long by 2½ ft. broad. This bag will receive the uniform, accoutrements, and saddlery of a trooper, and will float buoyantly with them. Thus equipped a man can swim his horse across, and tow his belongings behind him with perfect success. The invention has met with warm recognition in the Russian service, where more than one distinguished officer considers that in independent cavalry operations, during raids into the enemy's territory, and in partisan warfare generally, it may be invaluable. General Gourko, who gained his great reputation by the brilliant raid across the Balkans which he carried through in 1877, goes as far as Skobeleff did in his ideas as to what cavalry may compass, and has recorded a deliberate opinion that rivers and canals need no longer constitute obstacles at which a well-educated cavalry need shy.

It is not in Russia only, however, that much attention has lately been paid to this portion of cavalry training. The French claim that it is they who have led the way here; and they have certainly given much time to such exercises. Their methods are much the same as those which Skobeleff approved of; but they make use of a floating spar to which the horses may be attached in groups; and which, being towed across, much assists their efforts. The importance of accustoming horses to enter the water readily, and not to be frightened at its cold, is justly much insisted on; and constant practice will also make the men become handy, and quick at the work in a marked degree. We read, too, in the *Revue de Cavalerie* of a novel experiment in turning existing materials to account which gave good results, and rendered horsemen independent of any special addition to their present equipment. The camp kettles, which every regiment, squadron, or smaller unit carries with it, were attached to stout poles, on which a small raft of great buoyancy was constructed. On this men who could not swim were

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drawn across; and uniforms, saddlery, arms, and accoutrements were likewise ferried over with great convenience.

The accounts of both Russian and French experiences finally teach us that, in order to render cavalry perfectly *au fait* in the particular duties we are dealing with, a period of training extending over not less than three months is required. Although less has been published concerning the efforts in the German army, we believe it is no whit behind either of its formidable rivals in studying such matters.

We should be leading our readers astray, however, did we not remind them that, where time is available, the more primitive methods of which we have spoken are not the only ones which the cavalry may adopt. Some knowledge of field engineering and bridging should also form part of a mounted officer's stock of knowledge, and skilful, ready hands may improvise a pathway across a river in a wonderfully short time. The record of some experiments carried out at Limoges last August describes how a regiment of mounted Chasseurs, assisted, it is true, by a captain of engineers, threw an improvised bridge across the river there in a few hours. The structure was no less than 56 metres long, and was composed completely of such materials as presented themselves on the spot -old telegraph poles, casks, trunks of trees, planks, etc,—and in three hours the work was completely finished and the regiment marched across without the slightest mishap of any kind. Of course the rapidity of the current, the nature of the bottom, the steepness of the banks, and the depth of the stream are all important factors in the problem, without considering which it is impossible to give a decisive opinion as to the merit of the performance. And the reports do not go so closely into these matters as we might wish. Making all due allowances for favorable circumstances, however, enough remains to show how much may often be accomplished, and the value of such a bridge, sufficiently permanent to take many regiments over, is very clear. It is, indeed, to be wished that every regiment could rely on a few officers and men with a complete knowledge and aptitude for field engineering, and should be able to undertake duties at a pinch with the same readiness that is expected in most armies from engineers or artillery alone. Courses of instruction, no doubt, are annually held already, and the importance of this side of a trooper's education is not, therefore, altogether overlooked. But we fear that those who have been instructed are not required to put their knowledge to practical application as often as might be wished, and that the passage of obstacles scarcely forms so large a portion of the ordinary routine of a drill season as is desirable. It is a noticeable fact that Napoleon recognized the immense assistance which mounted engineers might be to an army, and Frederick the Great, in his desire to develop the efficiency of his squadrons, turned his thoughts in the same direction. He would like, he tells us, to give the advanced guard mounted sappers to break up the enemy's road, cut down small woods, make a small bridge, mark a ford, prepare positions for defense, or cut down or scarp the banks of a rivulet. General Brialmont, a high modern authority, would attach a company of mounted sappers to each division of cavalry for duties such as Frederick had in view, and quotes the experience of the American War of Secession

to fortify his arguments. In these days when railways will play so important a part in military operations, work of destruction, if not of construction, may often have far-reaching results, and the opportunities of a leader of cavalry, raiding far ahead of the force behind him, are immense. With an army such as ours every man is needed for his own particular place, and we can afford few specialists. What an engineer can do a cavalry soldier can, within certain limits, also undertake, and there seems no reason why regiments should depend on adventitious aid to perform duties which they might easily enough with a little special education be equal of themselves. Nor need the dash and rapidity which must always remain the main characteristic of horsemen be sacrificed. To be ready for all emergencies is surely no unworthy ambition for even the smartest and most enthusiastic sabreur.

A GENERAL REVIEW OF EXISTING ARTILLERY.

A LECTURE PREPARED FOR THE INTERNATIONAL CONGRESS OF ENGINEERS AT CHICAGO.

By GASTON MOCH, Captain of Artillery.

Translated at the Military Information Division, War Department, A. G. O., Washington.

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CHAPTER II.—TORPEDO SHELLS AND PNEUMATIC GUNS.

DIFFICULTIES IN OBTAINING PENETRATION.

STRICTLY speaking, in the race between armor and guns, the gun has been victorious. At least it appears certain that were a vessel constructed furnished with armor thicker than that of all others, such a vessel could be furnished with artillery capable of piercing her own plates and consequently those of others. The gun has already a long start in the race, because were an armor found which was impenetrable to actually existing artillery, it would be sufficient, in order to overcome it, to take a step in the abandoned direction of increased calibres.

But it has been shown what enormous difficulties lie in the way of obtaining the enormous living force necessary for this undertaking. And moreover at present it is a question of results obtained at the proving grounds and not those obtained from experience in actual combat. At the proving grounds the firing is at very close range. So far as actual penetration is concerned this makes no difference, because the propelling charges are modified so as to obtain a velocity of impact corresponding to the given distance; but the velocity at the moment of impact is not all that is to be considered; the probability of striking, as well as the angle of incidence, must also be taken into consideration. Thus in actual combat the chances of hitting are slight, in direct ratio to the smallness of the object, the movements of the ship, the conditions of the sea and atmosphere, and the excitement of the guns' crews. Moreover, it is only by firing at right angles to a vessel that there can be any hopes of striking it normally, for should she

present either extremity, the projectiles will encounter enormous thicknesses of metal and slanting surfaces. They will either glance off or remain imbedded and their explosion will not cause any great damage as their bursting charges are necessarily small.

INDIRECT ATTACK OF ARMORED SHIPS.

51. In land warfare, when a position is too strong to be carried by direct attack, an endeavor is made to turn it, and the latest improvements in artillery have made this expedient a general rule. The successive increases in the strength of armor plates have introduced a corresponding tendency in naval artillery.

An armored ship may be considered as a sort of floating bell closed by the armored belt and deck and prolonged by two nonresisting parts. Above the armored deck are superstructures as flimsy as a house of cards; and below, the hull, containing all the vital organs of the vessel, is likewise constructed of plates varying from 4 to 6 millimetres in thickness.

These vital organs, which are the objects to be reached, are therefore protected above by a relatively thin-armored deck of from 8 to 10 centimetres thick, and latterly by the armored belt which is as much as 52 centimetres in thickness. Below this belt, however, piercing projectiles are no longer to be feared; for were they fired with "full sweep" they would have to traverse an enormous thickness of water, which after all is the best armor, before reaching the hull; moreover, the majority of them would ricochet upon striking the water. The most redoubtable enemies in this case have thus far been the torpedo and the ram; and the leaks which they cause have been admitted to be unpreventable (since it is impossible to offer them effective obstacles) and the only effort made to control them has been to localize them by the use of water-tight bulkheads and coffer-dams.

So the protection against artillery attack, while so considerable on the water line, is weak in the region of the armored deck and nearly nil with respect to the machinery. This has given rise to two ideas, the one being to crush in the armored deck, and the other to destroy the hull by means of torpedoes.

The armored deck never was able to afford protection excepting against projectiles striking at very low angles of incidence, but even in firing at full sweep this protection has recently become insufficient. M. Croneau declares that "recent tests have shown that if the broadside of the lighter works is constructed of sheet iron alone, when a projectile charged with only 25 kilograms of melinite reaches a position, say, of 40 to 50 centimetres above the upper edge of the armored belt, it will pierce the sheet iron of the broadside, explode about 2 metres inboard, and destroy the armored deck for perhaps a metre of its surface, driving into the interior of the protected parts pieces of débris 200 kilograms in weight, at a velocity of from 60 to 80 metres per second; the splinter deck will be unable to stop these fragments, and thus the vital organs may be destroyed and the hull of the vessel itself pierced. Therefore, the explosion of a melinite shell of medium capacity immediately over the armored deck will suffice to detach from it large pieces which will become veritable projectiles capable of sinking the vessel.

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A start has been made to counteract this effect by surmounting the armor proper by a light armored coating some 12 centimetres thick and rising 1 metre 20 centimetres above it, for the purpose of causing the projectile to explode before it can arrive over the armored deck. This expedient is ineffective, since it is based on the supposition that retard-action fuses will not be used. The tendency at present seems to be rather towards constructing a second armored deck under the first one to stop the débris.

52. It may be possible that these measures will definitely vanquish explosive projectiles fired with "full sweep"; in this matter experience will have to decide. But they certainly will be insufficient against a plunging fire and against projectiles whose fuses are not sensitive enough to explode on contact with the thin plates of which the superstructures are made. In this latter case it would be useless even to have recourse to high explosives, the effects of which are, on the whole, rather difficult to control, and it would appear that a vessel which received a projectile from a howitzer or a 20 or 30 centimetre mortar at a high angle would be destroyed.

Thus at present, an entire school extols this mode of attack. It has in its favor the relative lightness of guns and ammunitions, and as a consequence, the facility of multiplying the number of rounds fired, and finally the immense effect of a lucky hit. On the other hand, it has to contend with the difficulty and uncertainty of a plunging fire, which are no inconsiderable drawbacks when directed upon a fixed object and which verge upon impossibility where the object aimed at is endowed with considerable rapidity of motion. Can the number of rounds compensate for the meagre chances of making a hit? This is at present unknown, and remains to be demonstrated.

After all, this idea possesses but an indirect interest for us; it cannot lead to important improvements in the constructor's art. The howitzers and mortars at present in use are amply sufficient for these purposes; they could be lightened only by perfecting their construction and that of their carriages, from the point of view of rapidity of fire; and placing them on shipboard, were it undertaken, would simply give interesting work to engineers charged with moderating their recoil. These, however, are mere matters of detail, the last of which does not even concern the gun constructors.

In attacking a vessel by artillery, the interest from this point of view consists in turning the principal obstacle, viz., her armor. The first suggestion in this case would naturally be the employment of ordinary projectiles and a plunging fire against the armored deck. This being, however, but the resurrection of an ancient method under a form adapted to modern circumstances, no time should be lost in modifying it and considering the rôle of the projectile from an entirely different point of view.

THE FIRING OF TORPEDO SHELLS AT A LOW PRESSURE.

53. So long as explosive shells were loaded with powder they could be defined as projectiles destined to penetrate by their living force and to explode afterwards. The power of the new explosives has relegated penetration to a second place—at least, so far as concerns obstacles which

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are not, like armor-protected walls, possessed of great resistance in themselves. With regard to an obstacle of less resistance, it is sufficient for destroying it that the projectile shall explode by the shock of contact; or even, as has been shown above, at a small distance from it without touching it.

This gave rise to a revolution in the construction of the projectile itself. Its metal body, being no longer intended to act by its mass or by its fragments, becomes useless—even detrimental—since it occupies the space of the actual engine, viz., the explosive itself, and the ideal would be to launch a simple package of explosive furnished with a fuse. As, however, the body of the projectile cannot be done away with, it is reduced to a minimum, and becomes no more than a case intended to carry the greatest possible quantity of explosive. Thus the conception of the torpedo shell was arrived at.

This term should be defined with precision. It has been extended to projectiles that differ from the old ones only in the substitution of some high explosive for ordinary power, an extension that lays the mind open to vexing confusion. These projectiles, with thick walls and containing as a consequence but relatively small explosive charges, may be called shattering shells, to distinguish them from the powder-charged shells. But the name "torpedo shell" should be restricted to projectiles whose thin walls are considered merely as the means of carrying to its destination as heavy a charge of explosive as possible.

54. About ten years ago the question was put to a practical test in the United States; the projectiles used appear to have been always charged with dynamite, taking the word in its broadest sense as designating mixtures of nitroglycerine.

As these products, if fired without precaution from an ordinary gun, could not fail to explode in the bore, two different methods were devised to counteract it.

The first consisted in retaining gunpowder as the propelling means, using however low charges so as to minimize the shock of explosion, and placing between the projectile and the cartridge a wad intended to still further deaden the shock as well as to prevent the development of heat from reaching the dynamite. Although inventors carried on their trials in this direction with a persistence worthy of a better result, it does not appear that those conducting the firing of dynamite by the above means succeeded in rendering it as dangerous to the enemy as to themselves.

Another school sought the solution of the problem in an entirely new direction, namely, that of pneumatic guns. Compressed air is, indeed, the most docile agent of propulsion, within the limits of pressure, that can be obtained. It is introduced as gradually as may be determined upon so as to give the projectile its first displacement; the pressure is then increased to a maximum which may easily be maintained until the projectile leaves the muzzle of the gun, when the supply valve is automatically closed. Thus at a single stroke the ideal powder was obtained, since the curve of pressures is reduced to a direct horizontal, with the exception of the short ascending arm, which is absolutely indispensable to avoid a sudden shock at starting the projectile.

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This method has its advantages and disadvantages. The former appear to have been especially perceived in America, the latter in Europe; but what will eventually turn the balance to the detriment of pneumatic guns is, I think, that the necessities which urged forward their study no longer exist.

The principal advantages have been already set forth. Nitroglycerine can be fired with complete safety, and the pressure be so regulated at the will of the gunner, that the guns, to take the *Vesuvius* as an example, require no elevating apparatus, their range being obtained by means of varying pressure. It should also be added that, in spite of the complication of their details, these guns can be built in a good deal less time and for a great deal less money than ordinary cannon.

Their disadvantages, however, are serious, for they can be used only for a plunging fire at relatively short distances. As a matter of fact this is also the case with all dynamite guns; but it will be seen that there is no reason to adhere obstinately to the use of so unstable an explosive.

Again, pneumatic guns require to compensate for their low pressure by an extravagant length, and the gravity of this defect has been already shown. This defect is bad enough on shore, but at sea it becomes intolerable. Thus the whole length of the *Vesuvius* is encumbered by her two guns, of which she is, properly speaking, but the floating carriage. Their breech is at the bottom of the after hold, while their muzzle is forward on deck. This answers very well for the pointing as to elevation, which is easily enough controlled by varying the air pressure, but the traversing has to be obtained by varying the position of the vessel herself, and no matter how easy she may be to handle it is highly doubtful whether while under way and in all kinds of sea she can answer to the action of a crank worked by a gunner looking through the sights.

As to the engines for the compression of the air, they present nothing out of the ordinary on shipboard, but it is doubted if they would meet with much success with artillerymen on shore. These latter, in Europe at least, appear to have a tendency to prefer to have their propelling force given them under the very manageable form of an already-prepared solid matter which they have only to introduce into the piece. This latter criticism, however, may be waved aside, as after all it is only based on a routine which new habits would easily overcome.

THE USELESSNESS OF PNEUMATIC ARTILLERY.

55. But, after all, is it really necessary to fire dynamite projectiles? If pneumatic guns are a novelty, it must not be forgotten that there is something still newer, namely, the various high explosives now in current use in the armies and navies of several European countries, all of them presenting that stability which is lacking in dynamite. Up to the time when these trials were made, dynamite and gun-cotton were the only high explosives known. To-day, however, the situation has completely changed, and it would be a useless waste of time to measure the effect of pressure on projectiles which do not feel it. It would be even detrimental, for it would be perpetuating a plunging fire as a system, and thus falling into that vexing

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tendency so energetically opposed by Mr. Longridge, which consists in wasting gratuitously a fair portion of the power of the propelling agent.

Admitting that there were no guns in existence and that there was complete liberty as to the decision between two different systems, the one selected, all things else being equal, would be the least expensive and easiest of construction; and so pneumatic guns and not the ordinary ones would be manufactured.

But a large number of these latter are already built, and no one is ready to abandon their use, as there is but little probability of coming to the decision of firing torpedo shells only. As for the projectiles of actually existing guns, as soon as they are charged with a proper explosive they can be used equally well and even better in ordinary cannon, since they can be fired with a "full sweep" at long range and with better aim. Therefore why construct for them special guns, whose use is not without grave disadvantages?

To sum up, pneumatic artillery owes its existence principally to the double circumstance that, when the United States began the reorganization of its coast defenses, the only high explosive known was of very uncertain action, and American manufacturers were not at that time in a condition to furnish steel guns proper. The first of these guns was adopted in 1885, and was but a field-piece of 81.3 millimetre calibre. But since the appearance of the new explosives, and the giant strides made in American metallurgy, America produces guns of all calibre up to 406.4 millimetres. It is therefore fair to suppose that pneumatic guns will disappear with the causes that brought them into existence.

56. Nevertheless if, as it is thought, their existence was ephemeral, it was not without use, for it brought into evidence the efficiency of what I have termed the "indirect attack of an armored vessel." I have already described the damage caused by a shell containing but 25 kilograms of melinite bursting over the armored deck after having gone through the thin plates of the bulwarks. Imagine, then, the effect of a real torpedo shell striking in the same place after having gone through one or two of the light decks of the superstructure. Yet these conditions of incidence are the same as have been obtained by pneumatic guns, and which would give the same angles to "full sweep" fire at long range.

Moreover the pneumatic gun has contributed toward establishing the fact already very clearly demonstrated by theory and by torpedo practice, that it is by no means necessary that the charge of explosive be introduced *into* the vessel, or brought even into immediate contact with it. The effects are, perhaps, still more dangerous if the explosion takes place in the water, at some distance from the vessel and at sufficient depth to cause the water to "pack." Under these conditions the water, compressed by the action of the gas generated by the explosion, forms a ram which crushes in the hull of the vessel, and causes interior damages that render all protective measures ineffective.

This fact is of fundamental importance; for, in creating all around the ship a zone in which the explosion of a torpedo shell is disastrous, it augments, so to speak, the size of the object to be hit. If the vessel be struck

anywhere excepting on the armor plates, the armored deck is stove in and the débris driven into the interior; if the ship be missed and the projectile does not fall at too great a distance from her, the hull will be crushed in. To attain this end it is sufficient that the angle at which the projectile strikes be not too small, for if this were so, the projectile would, in the first case, pierce the superstructure from side to side without exploding, or it would be stopped by the armored belt; and in the second case, it would ricochet or explode in the water before having attained a sufficient depth, and the force of its explosion would be lost in the atmosphere. This condition, *i. e.*, not aiming quite horizontally, is brought about by a slightly plunging fire at short distances, or by a "full sweep" fire at long range.

It can be seen that not only does powder actually lend itself perfectly to the indirect attack of armored vessels, but that it also solves the problem more completely than do pneumatic guns, which are restricted to use at relatively short ranges, and possess less accuracy of aim.

SECOND PART—FIELD GUNS.

CHAPTER I.—PRESENT TENDENCIES TOWARDS REMODELING THE ARMAMENT.

57. As far as the continental powers of Europe are concerned, sea operations present but a secondary importance; for it is on land, and more especially in the open field, that the decisive actions of a great war will take place. It is therefore natural that each particular power should be more preoccupied in perfecting its field artillery rather than its coast or naval guns.

Many reasons combine to make this tendency towards improvement the order of the day; at least it is currently talked of, without, however, having a clear idea as to exactly what is to be suggested, and above all without any particular country caring to be the first to undertake the formidable expense of a reform, in which its neighbor might surpass it on the morrow.

58. One of the causes, and by no means the least, is the entrance of private enterprise into the question of armament and the fever of competition by which it is characterized.

In the good old days each State possessed its own gun foundries, where they were content to follow out models consecrated by time. The public finances were not accustomed to the periodical drains demanded by the remodelling of armaments in times of perfect peace. The Vallieres and Gribeauvals, capable of conceiving reforms and possessing sufficient credit to be authorized to carry them out, were astonishing exceptions. Everything was limited to perfecting details, or to the adoption of some new parts, which were added to those already existing.

To-day the Vallieres and Gribeauvals are legion, in pretension if not in worth; they spring up not only in the artillery arsenals but in private factories also. All of them are not equally versed in the requirements of warfare, but all take out patents, construct guns, and show an equal desire to have them adopted. The press also takes a hand, and the public learns each morning of the birth of a new system that is destined to eclipse all

others, and is lucky if its adoption is not also announced at the same time.

This alone is enough to engender and keep up the idea that a change of field matériel is imminent; moreover, every one is convinced that the same kind of competition is going on among the neighboring nations, and the fear of seeing themselves surpassed by their neighbors accelerates this movement.

59. These tendencies, however, arise also from purely military causes and are consequently more interesting for us. They are directly allied to the three fundamental improvements that military small-arms have undergone in the last quarter of a century: loading by the breech, the introduction of the magazine, and the reduction of the calibre.

As far as artillery is concerned, the first of these changes is an accomplished fact; but the two others, namely, rapid fire (which corresponds to the magazine of the rifle) and reduction of calibre, are burning questions vehemently discussed. By turns they are proclaimed indispensable, useless, and even detrimental; they are declared as immediately realizable, or their realization is put off to a more or less remote period.

The question is not reduced to these two terms. A rifle bullet remains always a rifle bullet and is never anything else, whether it be made of pure hardened lead, or even of some other metal; whether it be jacketed or not its functions remain unchanged. Ordinary shell shrapnel of all kinds, "shattering shell," or "torpedo shell" are open to interminable controversies, as are the merits of percussion, or time fuses, plunging or "full sweep," direct or indirect, regulated or progressive fire, or fire by "rafales" (sudden gusts). It is very evident that all these questions must be set at rest before undertaking the establishment of a system of artillery which possibly may follow the most diverging courses, according to the point of departure that may have been chosen.

COMPARISON OF FIELD-GUNS WITH ARMOR-PIERCING GUNS.

60. This is not a single and well-defined task, as is the case with armor-piercing guns. The results required of field-guns are, on the contrary, varied in the extreme, and it is a matter of impossibility to give to many of them a numerical value.

Although field-guns may be called upon for the destruction of serious obstacles, this is not their principal mission; for as a rule they are opposed to men, that is to say, to objectives that a single bullet will put *hors de combat*. And these objectives are not counted as in naval warfare by unities, but by thousands; from whence it follows that the desired effect is to obtain, not a small number of serious hits, but a large number of comparatively slight ones, and consequently the efficiency of the projectile will have to be sought in the number of fragments into which it will break up, and not in the impact of its mass. There is another important consideration, which is important, although it cannot be put in the form of an equation, and that is that men are easily impressed, and the moral effect of artillery fire can be much greater than the physical; this is true to such an extent that it is quite possible that an armament really much inferior to another ap-

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peals more strongly than the latter to the imagination of the troops opposed to it.*

On the other hand the conditions of field firing are not like those of marine firing, which takes place at sea, that most level and unobstructed of polygons. Field firing is conducted over all sorts of country, inequalities of ground, cultivated fields, woods, or buildings. Often the object aimed at is unseen, and at times is so screened by intervening obstacles that it can be hit only by using high angles of fire.

In fine, in land warfare questions of mobility assume preponderating importance, whether they refer to the mobility of the batteries on the field of battle or to the means of transport which supply them with munitions.

61. To sum up, in comparing the field with the naval gun, the characteristic points of difference are found to be as follows:

At sea in armor-piercing fire the objective is a single solid mass of small dimensions, and the effect sought for is easily calculated; it requires the realization of a certain living force at the moment of impact rather than a multiplicity of projectiles. The field of fire being completely unobstructed, the fire is direct and in "full sweep," and the weight of the matériel, if it be not absolutely a matter of indifference, may at least vary considerably.

On shore the objectives are animated, numerous, and scattered over an extensive area, and the effect sought is of a moral as well as a physical nature. The projectile acts not so much by itself as by its fragments, which are equivalent to so many small projectiles with but a low remaining living force. The field is uncertain in character and may demand the employment of the most varied methods of fire; and the weight of the matériel is one of the preponderating elements.

The functions and the modes of employment of these two classes of guns give them characteristics diametrically opposed to each other; and though a constructor be thoroughly versed in the construction of naval guns, and an eminent metallurgist besides, his field-guns may be deplorable.

COMPARISON OF FIELD-GUNS WITH THE RIFLE.

62. The attempt has been made to assimilate the field-gun with the rifle alleging that it was nothing more than a rifle enlarged. From such a standpoint all diminution of calibre which is accompanied by an augmentation of initial velocity and of the transverse density would constitute an improvement in the field-gun in the same manner as in the rifle. But such an idea of assimilation fails to recognize the conditions under which the field-piece is used, as well as the present possibilities of the execution to be done by it. According to the direction in which it is exaggerated, it will produce an arm that is tactically inferior or materially unrealizable.

Let us first of all bear in mind (see § 27) that the latest improvements in bullets have not by any means been accompanied by an increase of trans-

* This fact appears to have been made patent in the army of the north, in 1870, when Gardes Mobiles, armed with old-fashioned muskets transformed into breech-loaders (Snider system), lacked confidence in their arm, which, as a matter of fact, was inferior to the Chassepôt. Yet the German troops facing them preferred to meet better armed troops, as the bullet of the Snider was supposed to make a more dangerous wound than that of the Chassepôt.

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verse density, which has steadily remained in the neighborhood of 30. It is the spherical density which has undergone an increase parallel to that of the velocity. Starting from the value 5.1 (rifle calibre, 11 millimetres), it has gone up to 8 (rifle calibre, 8 millimetres), and to 10.4 (rifle calibre, 6.5 millimetres).

In cannon also there has been an increase of the spherical density of the projectiles, although in much smaller proportions. The densest field projectiles at present in use are the English shrapnel (3.5 spherical bullets) and the Spanish shrapnel model, 1891 (4.09), although this latter has not as yet passed beyond the stage of trial. Among projectiles proposed by constructors the densest that I know of is the Canet shrapnel shell of 70 millimetres (4.61).

Thus it will be seen that rifle bullets have actually reached twice the relative weight of the densest shrapnel. The question to be solved is whether or not this is accidental, and whether it depends on us to make it up, or whether it is due to the intimate nature of the arms and projectiles under consideration.

63. The augmentation of the spherical density may be obtained in two ways; either by retaining the calibres of the existing matériel which it is proposed to improve, or the weight of the projectile.

The first solution is, *a priori*, absurd in the case of field-guns, for it would lead to too great a weight of projectile. The present weights may be considered as sufficient or even too great; but there is no officer who finds them to any extent too small. Thus, at a density of 8 the projectile of 8 centimetres would weigh 15 kilograms, and that of 9 centimetres, 21.360 kilograms; at a density of 10.4 these projectiles would become 19.520 kilograms and 44.050 kilograms respectively. The second scheme, namely, to reduce the calibre of the gun, embodies nothing so clearly inconsistent, and is, indeed, very much lauded. It constitutes at present the only means of obtaining a ballistic improvement of any importance, but we must not be misled as to the extent to which means can be employed and consequently as to the results that may be expected.

It will be seen further on that reducing the calibre is very soon limited by the difficulties encountered in giving to the projectile the indispensable internal arrangement. But before entering into the discussion of these details, which are the indirect results of an exaggerated increase of the spherical density, it becomes necessary to consider the fact, paradoxical as it may seem, that the conditions for loading usually employed for rifles may appear absurd when applied to certain classes of cannon.

64. The reason, however, is simple and arises from the fact that the length of these guns is limited.

If it is desirable that one particular arm should develop more living force than another without being subjected to a greater maximum pressure, the path of the projectile must be increased so as to obtain from the prolongations of the pressure what is not required from elevation. This point has already been sufficiently insisted on in the discussion of armor-piercing guns.

But field-guns as well as rifles have their limit of length, which is deter-

mined by the conditions of the service required of them, entirely apart from and independent of ballistic progress. As a matter of fact, the length of these two kinds of arms has varied but little in the last century.

It will be found that the customary length given to small-arms in reference to the height and muscular forces of man, is adapted, owing to the relative smallness of calibre, to all ballistic progress. It has remained very nearly a constant absolute value, and consequently has become relatively longer. Twenty years ago it was about 70 calibres; to-day it has reached 100, even 110, as will be seen from the following table:

Rifle.	Calibre.	Initial velocity.	Spherical density of the balls.	Path of the projectile in the gun (about).
	Millimetres	Metres.		Calibre.
French model, 1874.....	11	450	5.1	72
French model, 1886	8	632	8	94
Italian model, 1891.....	6.5	709	10.4	100
Mannlicher (long).....	6.5	730	10.4	110

If, therefore, it were desired to construct a gun possessing the ballistic qualities of the long Mannlicher rifle, its length should be equal to 110 times its calibre. But the longest gun actually existing in Europe is the Sotomayor model, 1891, now being tested in Spain. Supposing we adopt its total length, 2.58 metres, as a constant, the course of the projectile in the gun, calculated roughly, will not be much over 2 metres. If, then, this path should be of 110 calibres, it would involve the reduction of the calibre to 18.2 millimetres, which would be pretty small for a field-gun! The projectile would weigh but 231 grams, and it is clearly unnecessary to enumerate the extreme difficulties to be encountered in giving it an internal construction; besides, if it were made, it would be contrary to the laws of nations to use it, since the convention of St. Petersburg forbids the use of explosive projectiles weighing less than 400 grams. Supposing it were decided that the path of the projectile correspond to that of the rifle model 1874 (viz., 72 calibres), its calibre would still be but 27 millimetres.

65. From this point of view the difference of transverse density that distinguishes the rifle bullet from the field shell is thus not merely a question of plus or minus; it is an absolute impossibility to overcome it. If there are any who believe the contrary, it is because they have been led astray by the example of naval guns, whose conditions of service are very different from those of field-guns.

In naval guns there is no objection to great length of bore, which is inadmissible in field-guns. It has been seen that this tendency has been far from welcome, and that a strong reaction has been manifested against it. Nevertheless, if very long guns present serious drawbacks, it is yet true that lengths of 50 calibres are no longer a subject of astonishment and that there exist guns of 80 and 90 calibres.

These guns are, properly speaking, nothing but immense rifles. Their projectiles, for which every effort has been made to obtain the greatest initial velocity possible, are less dense than rifle bullets, but could be brought

nearer to them in density if the velocity were lowered to what it is for the rifle, instead of leaving it equal to about a thousand metres. This is clearly shown by the following table relating to tests recently reported in the papers* :

Gun.	Length in calibres.	Weight of projectiles.	Spherical density.	Initial velocity.	Pressure.
		Kilograms.		Metres.	Kilograms.*
Canet, calibre 57 millimetres.....	80	2.700	4.0	1,007	2,600
		3 000	4 0	993	2,840
Canet, calibre 80 millimetres.....	80	13.00	3.6	1,000	2,500
Armstrong, calibre 152.4 millimetres.	80	38 000	3.0	1,120	2,500
French, calibre 16 centimetres.....	90	45.00	3 0	1,214	2,500

*Per square centimetre.

It is to be remembered, however, that these are naval guns whose only functions are the piercing of armor plates. The last three need not to be considered, as their dimensions alone throw them out of the discussion. The 57 millimetre gun, with a length of 4.56 metres, is less impossible as a field-gun. Its long chase however renders it impossible to cross a ditch or descend any but a moderate slope with it; moreover, the smallness of its calibre and the lightness of its projectiles are incompatible with the proper construction of shrapnel for it.

It is, therefore, very possible that there may be some resemblance in design between the rifle and the naval gun, although too great lengths possess many grave disadvantages, but it is impossible that any can exist between the rifle and the field-gun. And it will be seen that the question of dimensions of the projectiles leads to the same conclusion as does that of the shape of the gun.

66. The nature of a projectile is determined by the effect it is to produce and the conditions under which it is to be used. Thus rifle bullets are constructed with a view of putting but one man *hors de combat*, and there is, therefore, nothing to prevent its being brought below its present weight so long as it be given a sufficient velocity and the means of keeping up this velocity.

Properly speaking, the projectile or fragment of projectile of a field-gun is also a bullet; at least on impact the simile is very nearly complete, and all that is required to put a man *hors de combat* is that it shall have sufficient body and velocity. The intensity of fire to which a body of men is subjected is measured in both cases by the number of bullets that reach it in a given time; the only difference being that it should be possible to fire the shot of a field-gun, if necessary, at such an angle as to strike troops under cover. This, however, is a matter of time-fuses and a plunging fire.

But here all analogy ceases, for, while the rifle sends its bullets singly and directly to the objective, field-guns obtain the effect by the use of the shrapnel,† which serves as a vehicle to a large number of these small projectiles.

*For account of Armstrong gun and the French gun of 90 calibres, see "Le Temps," April 26, 1892.

†To avoid confusion the word "shrapnel" is used to indicate all modern cases or segment shell with a very low bursting charge, whether they belong to the shrapnel or the shell type.

We shall speak later of the moral influence exerted by the modern idea of considering only the number of balls contained in the field projectiles. For the present it will be sufficient to say that the difficulty of their manufacture increases as the calibre is diminished, and that these difficulties do not exist in the case of the rifle. Hence arises the vexatious consequence that the number of bullets thrown by it diminishes with its calibre, whereas the diminution of the calibre of the rifle allows the soldier to carry an increased number of cartridges.

67. So far as the present matériel of the Russian army is concerned the following facts were brought out by Gen. Englehardt in a lecture delivered by him at St. Petersburg, February 17 (March 1) of the present year.

The bullet of the 4-line rifle (calibre 11.6 millimetres) weighed 24.3 grams; the soldier carried 88, which weighed 2.140 kilograms; those of the 3-line rifle (calibre 7.62 millimetres) weighed 13.7 grams, and if 150 were issued they represented a weight of 2.055 kilograms only. On the other hand, the Russian field and mountain gun showed the following number of projectiles and balls per thousand kilograms:

Calibre.	Number of projectiles.	Number of balls.	
		In each projectile.	Total per 1,000 kilograms.
87 millimetres	150	210	31,500
76.2 millimetres	150	150	24,000
63 millimetres	250	88	22,000

It should be noticed that as a matter of fact the discrepancy in proportion is not so great in all cases. In a projectile which is abreast of the latest improvements the dead weight can be greatly reduced and the number of balls augmented, the increase of their velocity making up for the decrease in their actual weight. But whatever be done, the certainty remains that an increasing difficulty will have to be encountered in establishing the projectiles in good conditions of efficiency and that the reduction of calibre will not, as in the case of the rifle, increase the number of bullets.

68. This difference of conditions in the two species of projectiles has caused their relative weights to vary in an inverse ratio. Progress in small-arms ammunition has consisted in obtaining the desired effect by means o smaller and lighter bullets and by multiplying the number of shots fired in a given time; whereas in field-gun ammunition the progress has consisted in similarly reducing the weight of the fragments of the shell, large splinters being replaced by small bullets. At the same time the number of bullets fired simultaneously has been increased, as has also the total weight of the projectile.

Moreover, the weight both of the rifle and of the field-gun has a superior limit which has not varied, because it is determined by the strength of the man in the one case and by that of the team in the other. Progress in the manufacture of small-arms has consisted in imparting the necessary initial velocity to these very small bullets, while the field-gun was necessarily outstripped, as the weight of its projectile increased instead of diminished.

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From this we have the well-known statement cited by Gen. Engelhardt in his lecture, to the effect that the ratio of the weight of the arm to that of the projectile has been decreasing in field-guns and increasing in rifles.

The following are the figures given by Gen. Englehardt for Russian field-guns.*

Dates.	Weight of pieces in battery.	Weight of projectiles.	Ratio of weights.
	Pounds.	Pounds.	
1856	2,400	6	400
	2,800	12	233
1883	2,400	17	141
	2,800	30	93

On the other hand, small-arms show very clearly that their progress has been in an inverse ratio, as will be seen from the following tables, for the last thirty years in France:

Arm.	Weight of arm.	Weight of projectile.	Ratio of weights.
	Kilograms.	Grams.	
Model 1857	4.255	36	118
Model 1866	4.140	25	166
Model 1874	4.760	25	190
Model 1886	4.580	15	305

69. There exists between small-arms and guns another fundamental difference, which will be set forth later on in the same terms that have already been used to clear away a misunderstanding that occurred.

"In rifles the endeavor has been to obtain the flattest possible trajectory, so as to increase the danger space and to permit the use of point blank fire up to considerable distances. According to this view, the adoption of a small calibre and great initial velocities has indicated a marked progress towards the ideal rifle, whose bullet throughout its entire flight should not rise to a greater height than that of an average man.

"These considerations, however, have nothing to do with field-guns. With them explosive projectiles and low velocity have obliterated the importance and even the idea of a danger space; as to fire at short range, the enemy's rifles have destroyed that. In fine, as soon as the middle distances have been exceeded the elevation of the flattest trajectory is measured in hundreds not in tens of metres. This, however, is very fortunate, since the conditions of a field-gun should permit of its being fired over the heads of friendly troops; for who would venture to use his artillery against an enemy's guns if he first had to assure himself that the intervening league

* These figures have not been reduced to the decimal (metric) system, because they come very even in the original. On the other hand, I have not replaced them by those relative to French guns because the 12-pounder field-gun, model 1859, constitutes in a way an anomaly in our matériel, and because the unusual weight of its projectile would warp the argument, which should not bear upon exceptions.

of country was as clear of friends as a proving ground? In other words, if it were possible to construct a field-gun with as flat a trajectory as the present rifle it should be rejected without further examination."*

A critic has thought to draw from this phrase the conclusion that I was ignorant even of the conditions of fire of the French arms. He calls my attention to the fact that at the distances of 500, 1000 and 1500 metres the elevations (of the trajectory) are, for the rifle model, 1886, 1.45, 9.69, and 32.02 metres respectively; and for the field-gun model, 1890-2, 8.50, and 19.50 metres.

It certainly would have been a blunder to assert that for the same distance the trajectory of the rifle bullet is flatter than that of the shell; but I did not foresee that I would be credited with the idea of comparing field-gun and rifle fire *at the same distances*, the absurdity of such a comparison constituting another difference between these two arms.

By placing the two weapons under conditions where a comparison of the two fires could be made, we should find that the distances of from 600 to 800 metres for the rifle correspond very nearly to those of from 2500 to 3000 for field-gun fire; 1500 metres for the former is very nearly equivalent to 5000 for the latter. Therefore, at the distances of 3000, 4000 and 5000 metres the elevations of the trajectories of the field-gun model 1890 are 113, 235, and 425 meters, respectively; and these ranges do not exist for the rifle.

What I did wish to say was that, at proper distances for artillery fire, it would be unfortunate to have trajectories as flat as those which the rifle has at effective, or even the greatest, ranges of infantry fire; since, at distances of 500 metres the field-gun is as inapplicable as the rifle is at 5000 metres. My idea was probably imperfectly presented; but it was sufficiently specified by the fact that the discussion referred to firing over friendly troops. This class of fire is entirely impossible for infantry; and how would artillery be able to employ it if at, say 3000 metres, its trajectory had but from 10 to 20 metres of elevation? Certainly no one would undertake, at 1000 metres, to fire over the heads of comrades, when the trajectory of the shot had an inclination of but one-fiftieth at its origin. Moreover, there are but few batteries that would venture so close in the effective zone of infantry fire, and even these would not remain long in action.

A gun with a flatter trajectory can, indeed, sweep a greater depth of ground with the contents of its shrapnel; but on the other hand, errors in aiming are considerably increased in importance, as are all others; for instance, those due to the time of the burning of the fuses. It would require a long series of comparative tests to determine the respective advantages and disadvantages of either.

To sum up, the ballistic conditions to which both rifles and field-guns are subjected are not identical, as has already been said. They are, in fact, absolutely opposed to each other. The rifle is the fighting arm of relatively close combat, and in its radius of action should have as flat a trajectory as possible. The domain of the field-gun commences at a greater distance;

* "Notes on the Field Gun of the Future," Section II.

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the effectiveness of artillery would be destroyed if, at the normal combat distances, it were necessary, as is the case at the proving ground, that there should be no men between it and the objective.

In field-guns, therefore, it would be a grave error to seek low trajectories. This "retrograde progress" would bring us back to smooth-bore guns by removing the benefits derived from the present long ranges, which enable a battery to bombard two points situated several thousand metres apart without changing ground or taking account of anything which may be in the intervals.

70. I have already said that the rifle is, as compared to field-guns, the arm for relatively close combat. In spite of its most recent improvements and of those to which it will in future be additionally subjected, there remains another source of inferiority which will curb its ambition, and that is that the foot soldier cannot see where his projectile strikes; and the more the rifle is improved the more impossible will it be for him to see his bullet, which becomes smaller and has a longer flight. On the other hand, the artilleryman sees his shell strike, and, excepting in extraordinary cases, can regulate his range accordingly, so as to make it almost a certainty.

On the other hand, the rifle is an individual arm mounted on the worst of carriages, namely, an ignorant, impressionable man, and served by him exclusively. The officer plays an uncertain and difficult part in directing its fire; it is seldom in his power to judge accurately regarding its effects, and the corrections which he prescribes can be but indifferently executed.

The field-gun, on the contrary, being solidly established on its carriage, is not served by its detachment but by the captain, the detachment being simply the machinery by which it is manœuvred. Its business is merely to carry out simple orders that may be easily controlled by a non-commissioned staff in the immediate vicinity. The battery may be imagined as a six-chambered revolver, mounted on a stand, which the captain needs merely to aim, all other manipulations being performed by others. It is evident that—contrary to what is the case with the rifle—each projectile of such an arm possesses a maximum individual accuracy. Hence its rational use will not consist in uselessly multiplying the projectiles aimed at the same place, but in giving each of them an efficiency appropriate to the accuracy of fire. I do not mean by this that there is no advantage in increasing the number of rounds fired in a given time, but that it should not be attempted until after having secured for each of them all the power compatible with the other essential conditions of armament.

71. This long discussion is not, as might apear, simply an idle digression. The comparison between field-guns and rifles, if carried too far, would have no value except as an interesting academic discussion; but it is well to pay careful attention to the subject of essential differences which could not be ignored without arriving at the falsest conceptions of the results to be obtained. Thus one might as well maintain that an armored cruiser involved the same principles as a pleasure yacht. Both float on the water, and it is to the advantage of both that their machinery shall give them the greatest possible speed; but the analogy goes no further, and it would be both undesirable and difficult to construct one on the lines of the other.

The same holds good in reference to the field-gun and rifle. Each of them has a distinct sphere of action which must be studied separately, rejecting all comparisons that have no special object, for their different requirements must result from organic principles no less diverse.

In all this it is by no means my intention to establish a hierarchy between the different fire-arms, graduated according to calibre and transverse density, the invention of which has been gratuitously laid at my door. On the contrary, in resuming this discussion, we come to the following less ambitious conclusions, which I think are such as to prevent constructors from falling into a number of mistakes.

Rifle bullets have latterly attained a spherical density (not a transverse density) which is entirely impracticable in field-guns. The ballistic conditions of the latter are essentially different from those of the rifle, in view of the impossibility of giving it a length of bore comparable to that of the small-arm, and the necessity of controlling the breaking up of its projectile.

By this I do not mean to deny that some other gun may be compared to a rifle. The argument will be reversed if the word "field" be dropped before the word "gun."

The long naval gun can, indeed, be perfectly compared to the rifle; their projectiles act in an analogous manner, penetration having to precede explosion. The shell have but a very small interior cavity and the result is obtained by the simultaneous augmentation of velocity and transverse density. The length of bore is not materially restricted by the conditions of their service.

Hence fire-arms comprise two great types of opposite character—on the one hand the field-gun, and on the other the naval gun and the rifle. The transition stage is exemplified by the siege material, which is now likewise involved in the struggle against armor, and will eventually have to complete the already long list of its ordnance with pieces analogous to naval guns.

MOBILITY OF CARRIAGES.

72. It has been seen that in naval guns the fundamental condition to be required is power. The power desired is determined by the thickness of the armor to be pierced, and by the distance at which this is to be accomplished. From these requirements their entire design is gradually deduced, and the result is reached that a minimum weight must be given to the piece if the proposed problem is to be solved. Should this weight be still too great we must lower our pretensions and sacrifice a little of the piercing power. In practice, however, we are not restricted on this side, as to-day we obtain satisfactory results from guns which are by no means as heavy as those shipped ten years ago.

With regard to field-guns the case is not the same; with them we must content ourselves with the power which a weight already given permits us to attain. Unfortunately the problem is not only inverted, but it is also greatly complicated by the uncertainty of the point of departure.

It is very evident that there is practically a limit to the weight which can be drawn by the teams, and this will practically give us the weight of the piece and its limber. From it we can calculate the relative weights of

both parts—that is to say, according to the quantity of ammunition to be carried on the limber. Finally, when the weight of the gun-carriage proper has been determined, a comparison of the actually existing material which is more or less susceptible of improvement will indicate how this weight can be distributed between the gun and its carriage proper.

In all this, however, what an amount of uncertainty and arbitrariness is displayed! The last part of the question is all that presents itself as a matter of calculation, and it will be shown farther on that calculation alone will not solve it. As to the first two parts, they depend upon nothing but mere experience, and, unfortunately, in such matters, experience is singularly difficult of application and gives rise to the most varied estimations.

73. No matter what may be done, the amount finally decided on as the proper weight for ordnance will always remain a matter of the utmost controversy. It is also noteworthy that the differences of opinion which are perfectly admissible in regard to it, are of greater importance than would at first be imagined.

I give below an example of this fact, which I have intentionally chosen from material that has been in existence for quite a number of years. If I had selected a more modern gun, since its force is greater, its variations would also be greater than that which we are about to discuss.

The French gun model 1880 weighs 425 kilograms; throwing a 6.280 kilogram projectile with a velocity of 465 metres, it furnishes an energy of 69,200 metre kilograms, or 163 per kilogram. Let us suppose that, without improving its construction (that is to say, retaining this same value of efficiency), it had been given the same weight (530 kilograms) as the gun model 1890; it would then furnish 86,300 metre kilograms of living force and, by retaining the same projectile, it would consequently give a velocity of 519 metres. If, on the contrary, the primitive velocity were retained, a projectile of 7.830 kilograms could be used. The gain of 54 metres in velocity (12.6 per cent.) would be a very small consideration; whereas a gain of 1.550 kilograms in the projectile (25 per cent.) would considerably increase its effectiveness; and if the consequent spherical density (4.17) were found to be too great for an initial velocity of 465 metres (which I do not think likely), there would be nothing to prevent the distribution of this increased energy between the weight and the velocity, which would give, for instance, a projectile of 7 kilograms (density 3.75) with an initial velocity of 492 metres—that is to say, the weight of the projectile would be increased by 11 and the initial velocity by 6 per cent. The latter item, however, is unimportant for we are not at present concerned with the influence exerted upon the power of a gun by an increase of 100 kilograms in its weight; for we should naturally expect to find as great a difference between the given weights of guns of two equally suitable models. If the gun is made 100 kilograms heavier, the carriage proper must also be increased by very nearly the same weight; and as there is no reason for modifying the limber the teams would only have to haul 200 kilograms more than the original weight.

74. It is not merely the weight of 200 kilograms that constitutes the difference of opinion of those who attempt to determine what the weight

of the piece and limber should be. The mobility of the battery is a vague element, and the value given to it depends largely upon the individual opinions of those who apply it. It furnishes a very uncertain basis for calculations just where a precise figure is most needed. Batteries attached to cavalry furnish a fair example of this uncertainty. There is an entire school of officers who demand that the detachments of men be no longer mounted on horses but be carried on the limber and caisson, in order to obtain greater mobility. They hold that, in addition to a clear gain of horses and men (the horse-holders of the detachments), which are difficult to provide for, the battery itself would occupy less room and would be much easier to handle; and as irregular lengthening out and closing up of the battery would be diminished, the march would be less fatiguing and could consequently be prolonged. Paradoxical as it may appear to increase the mobility of the battery by carrying the detachments on the limbers and caissons, the idea is well founded.

The question of horse batteries is, however, a secondary one, as in all countries the greater part of the artillery material is composed of field batteries, and they consequently form the most interesting subject of study. It would appear that the weight to be given to their carriages should be a determined quantity, since it does not depend on industrial progress. This, however, is not the case, and opinions are very considerably divided with regard to the matter, since they are based on the vague element of the vigor and endurance of the horse under the trying circumstances of a campaign.

It has already been stated as a singular fact that after a great war all agree in asking for more powerful material, and that after a few years of peace complaints are made of the lack of mobility of the batteries, this defect being the one most felt in manœuvres.

Immediately after the war of 1870 it was generally stated that 2000 kilograms was a good normal weight for gun carriages for field batteries. As a matter of fact this is the weight of the German carriages, and the French model of 1890 is only some 100 or 200 kilograms heavier. A very few years of peace have been sufficient to develop a marked tendency towards lowering this weight to that of the carriages of horse batteries—namely, 1600 kilograms in round numbers.*

75. It may be objected that an economy of 400 kilograms represents but 67 kilograms per horse, and that the teams would scarcely notice the difference, which costs so much to bring about.

This objection may be easily met by stating the fact that it is only in exceptional cases that the whole team of a gun works together, especially when it consists of six horses. The French regulations require that the near horses be spared by requiring only the off horses to pull together in ordinary roads, while in going downhill the whole work of the piece is thrown on the wheelers. From this it is seen that a difference of 400 kilo-

* The weights of the pieces used in the wars of the Revolution and First Empire were: 12-pounder, 1800 kilograms; 8-pounder, 1470 kilograms; 4-pounder, 910 kilograms. "And it is worthy of notice," adds Col. Langlois, "that the 12-pounder battery marched at a walk." Nevertheless the commission of the year XI, composed of generals who had gone through numerous campaigns, were unanimous in recommending that the 12-pounder should be made lighter.

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grams in the weight of the carriage is of much greater importance than it would be if equally distributed among all the horses of the team. In actual service, and above all with the inexperienced drivers and the impressed horses that would compose the teams in time of war, this weight would be thrown, successively and irregularly, now on one and now on another of the animals.

Nevertheless, I shall not undertake to show whether a gain of 400 kilograms would warrant the complete remodeling of the existing matériel, supposing this matériel to fulfill all other requirements. The utmost that I will say is that before forming a decision the loads of the carriages of the first line should undergo a strict revision, so as to get rid of the quantity of practically useless articles with which it is everywhere the pernicious custom to encumber the carriages. When this is done, I will consent to the limit being fixed at 1600 kilograms, which will allow of a gun more powerful than any now in use.

(*To be continued.*)

THE PROPOSED KIT FOR GERMAN INFANTRY.

By COUNT A. BOTHMER.

From the United Service Magazine, London.

THE efforts made by the military authorities of all countries during the last quarter of a century to render the individual soldier as independent as possible in time of war have been, no doubt, in the right direction so long as the weight each man had to carry was not too great. Every nation, however, in the attempt to outvie the other, has gone to extremes and has burdened its privates and non commissioned officers to an extent, which necessarily reduces marching powers. The question is all the more serious, because now the standing armies of most nations form only the nucleus of millions in case of a campaign. The men with the colors are accustomed to carry heavy weights, but the reserves, when called in to join their regiments, are mostly out of practice in such work. The difficulty they find in marching long distances with heavy weights, especially at the beginning of a campaign, is notorious. The spectacle of men falling out of the ranks during the early stages of a march is an unpleasant one for any commanding officer. There is no doubt that the example set by such men has a tendency to be infectious. Many a man who would, without that example, have reached the goal by hook or by crook gives in before the proper time. The strength of an army is in its legs as much as in anything else and there can be no doubt that the Franco-German campaign of 1870-71 was decided to a large extent by the wonderful marching powers of the German troops. This matter was carefully looked into after the war, and it was found that the German soldier made a stride on the march which was considerably longer than that of the French soldier. This is of course partly explained by the fact that the average German is a larger man than the Frenchman, but a great deal was due to proper training in time of peace. If

the reasons why the kit of the modern soldier has been increased so much be looked into, it will be found that they are chiefly attributable to a growth in the quantity of ammunition each man has to carry, and the tins of preserved meat and vegetables which form a part of the equipment, though these latter are only meant for use in case of the most dire necessity. In Germany the possibility of a war with Russia has probably been the reason of the introduction of the "iron ration." In a country like that which the Tsar reigns over, the means of obtaining food are extremely rare, and the burning of Moscow is still remembered as a warning of what might happen to a modern army invading Russia.

The magazine rifle, though lighter than the Mauser rifle, and the Mauser rifle with a magazine attached (both introduced after the Franco-German War), at once seemed to make it needful that the number of cartridges carried by each man should be increased, and in all countries it will be found that a step in this direction was taken, so that, as a rule, the number of rounds for each man was doubled. At the present day the distribution is as follows:—Austria, 100 rounds; Italy, 96 rounds; France, 120 rounds; Russia, 84 rounds; Germany, 120 rounds; England, 80 rounds. From these figures it will be seen that France and Germany have been on a level in this respect hitherto. It is due to the initiative of the German Emperor that the German private will in a short time have some 14 pounds to 15 pounds less to carry than formerly. It may strike many persons that an autocratic form of government, so far as armies are concerned, is not always a mistake, for as a rule innovations are extremely difficult to bring about when these have to be decided on by a Parliament which has not the technical knowledge of what is needful. My object is therefore now to give some details about the proposed changes in the German army, with which trials are to be made in ten battalions commencing in May. They will be carried on through the year until the end of September, when definite steps will be taken in the matter. The tunic worn at present is to have a soft collar which folds down, in place of the one at present in use, which is lined with a stiff material, and hinders the circulation of the blood, besides affecting the eyesight in a prejudicial manner. There will be no hooks and eyelets attached to the collar as heretofore; the tunic will be closed by the top button only. The tunic will be cut shorter, and will be divided behind. No stock is to be worn, in place of which a kind of collar is to be buttoned to the shirt. The stock at present in use is of thick black material, lined with grey linen, and with a leather strap and buckle behind, which has proved very inconvenient, and is difficult to keep clean. Calico shirts have been worn at present, but are to be replaced by some web material, probably similar to the Jaeger system of clothing. The men will be less likely to take cold in these garments, moreover a much smarter fit of the tunic is insured by their being worn, as they will fit closely without being uncomfortable. The regulation boots, which have been made much lighter of late years, are to be further reduced in weight, by the shafts being constructed of thinner leather, and by the heels and soles being less heavily shod with nails, which will probably be of aluminum. The drawers served out will be cut in such a way that they can be worn in quarters as ordinary trousers. Hitherto the men have been sup-

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plied with a pair of drill trousers, as well as those of cloth. In future these will be discarded, and during the winter months they will receive in their stead others of a different material to be worn in quarters. Thus in a campaign no second pair of trousers will be included in the kit. The helmet in use in the German army has always been unpopular, both with officers and men. It is the most difficult thing to make it fit, and is always trying to wear for any length of time, so that it would have been hailed with delight if this headgear had been done away with entirely. It seems, however that this is not included in the list of improvements. All that is proposed in this direction is to make it lighter, by making the metal ornaments smaller and of aluminum instead of brass. The German helmet would in its present form, cause very severe losses in a future war, for it betrays the presence of the troops at very great distances, and even that of a single man. The knapsack at present in use is covered with cowhide with the hair on, the shape being kept by a wooden framework. This framework will now be discarded, and the straps are to be made lighter, and will not be fixtures, but movable. The piece of tent carried by each man, and a bag for holding provisions—in this the iron portion is kept—are to be fastened under the flap of the knapsack at the back. Two small pockets at the sides will contain a packet of cartridges each. Belts and all straps will be cut half a centimetre narrower, the men will cook their food in vessels of aluminum, rendered black artificially. The strap of the provision-bag (brodbeutel) will not be carried from the shoulder during the march, but will be stowed in the bag itself. The men's coats are now lined down to the waist back and front with coarse linen, and also the arms. The lining in the sleeves and back is to be done away with, the back which now has quantities of folds will be made to fit more closely, and the turned up cuffs will be narrower. Gloves will be served out in winter only. They are of black cloth, lined, and without fingers, except for the first finger of the right hand to enable the man to fire without taking the glove off. The weight of brushes and polishing materials will be reduced by nearly half a pound; ninety rounds of ammunition will in future be carried by each man instead of 120: the bayonet will be replaced by another weighing a pound less than the one now in use; the tinned vegetables will weigh a pound less by being reduced in quantity. After the Franco-German War, the German authorities were much struck by the readiness with which the French threw up earthworks, and every other man in each company received a spade. Henceforth there will be only fifty spades, which, in a company of 250 men, would give this extra weight only every fifth day to each man, if fifteen axes and pickaxes be excepted, which will also form a part of the kit. The weight carried at present by each private in continental armies is:—Austria, 28.900 kilograms; Italy, 26.000 kilograms; France, 28,500 kilograms; Russia, 29.500 kilograms; and (after introduction of new kit) Germany, 26.100 kilograms. (One kilogram equals 2.204 pounds avoirdupois.) So that, after Italy, the German soldier will have the least to carry. As has already been stated, these alterations are still under consideration, and may be somewhat modified, but the facts here given are, in the main, correct.

THE NEW REGULATIONS FOR FIELD FORTIFICATIONS IN THE GERMAN ARMY.

Translated from the *Rivista di Artiglieria e Genio.*

By Lieut. THOMAS C. PATTERSON, 1st U. S. Artillery.

(*Continued from* Journal *No.* 69.)

HEAD COVER.

THE maximum efficiency of the infantry is displayed as soon as the enemy arrives within effective range. During the period that precedes, while the artillery duel is going on, it is exposed to losses which are greater in proportion to the numerical superiority of the enemy. It is therefore of importance to construct suitable cover for the protection of the infantry during this period. Instead of constructing a few strong covers it is better to supply numerous light ones, which will serve to protect sufficiently against shrapnel balls, fragments of shell, and direct rifle fire, if suitable inclination be given. Against curved fire, it is not possible to provide with the means at hand for field-works, and it must suffice to provide against it by a judicious disposition of the cover available. The works should not be contracted in front and should never be permitted to impede the development of the line of fire or the ready deployment of the garrison. Their construction should be so simple that they may be readily and quickly prepared by the infantry unaided.

The materials employed in their construction should be such as can be easily procured, such as doors, gates, planks, rafters, tables, wagon-shafts, etc. They should be solid, should have the prescribed dimensions, and satisfy all the conditions already indicated. The necessary solidity, in view of the diversity of materials available, may be indicated by the following rules: tables 5 cm. thick can support from 1 to 2 m. of earth; rafters of roofs of 10 to 15 cm. thickness can support from 2 m. to 4 m. If rafters of less thickness are used the intervals should be diminished or supports should be placed. Two or three layers of tables may be used to give the necessary resistance. An inclination of 12° or, 2 c.m. on 1 m. will protect against the effects of direct rifle fire. The front space, where the tables rest on the rafters, should be protected by fascines. The joints between the tables, etc., should be protected by light layers of earth mixed with small branches of trees. In this manner protection is afforded from fragments of falling shells.

If necessary the steps and the rear should be revetted.

In trenches already constructed a certain degree of protection may be secured by the use of doors, gates, roofing beams, tables, etc., as indicated in Figs. 7 and 8. These defenses, it is true, may be easily demolished, but

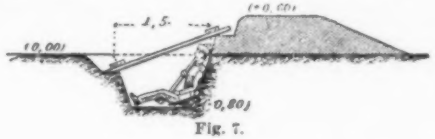

Fig. 7.

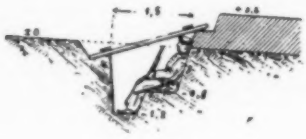

Fig. 8[a].

have the advantage of not retarding the development of the firing line.

By placing stakes and using tables as indicated in Fig. 9, cover may be

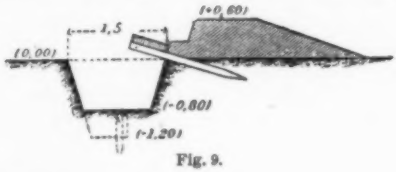

Fig. 9.

had, at least from shrapnel fire.

The tables are thrown off when the firing line is to be occupied.

The profile indicated in Fig. 10, in which the front of the ditch is made

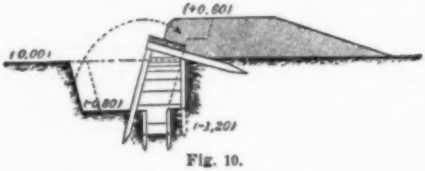

Fig. 10.

vertical and is revetted, and in which the parapet is strengthened in rear, is to afford protection against fragments of shell and shrapnel.

Other simple forms, to be excavated beneath the parapet and which do not retard the development of the line of fire, are given in Figs. 11 and 12;

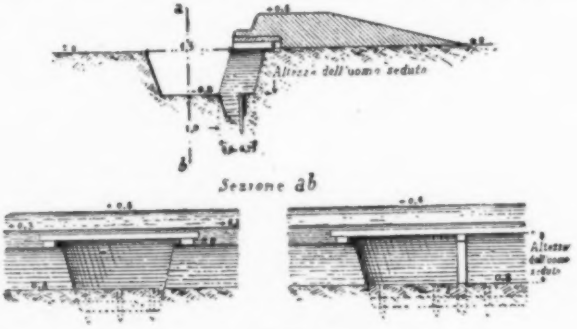

Fig. 11[a]

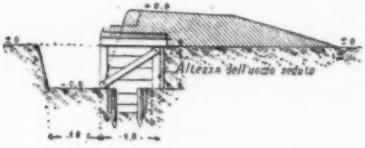

Fig. 12[a].

the first for solid ground, and the second for soft.

In the covers indicated in Fig. 11 there is room for a single rank of men sitting; in that of Fig. 12 two ranks may be posted. The latter is revetted. The height and width are so regulated as to allow the men to remain seated.

The necessary space for such cover should be provided for at the beginning of the work, leaving the ditch to be widened later.

Individual cover may be arranged by means of boxes or casks suitably placed.

The exposed portions of the rear of the trenches are protected by planks or tables.

Cover underneath the trenches may be afforded by means of the device

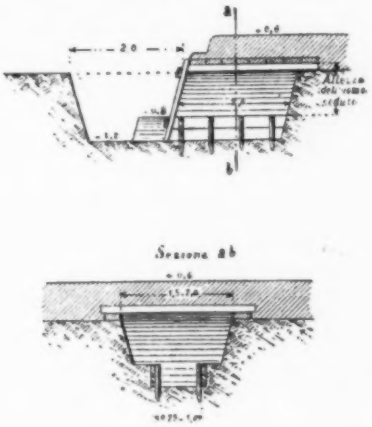

Fig. 13[a].

shown in Fig. 13, but the extension of such work forward is to be avoided.

If a diminution of the power of developing the firing line is not objectionable, or if it may be compensated for by a lengthening of the ditch, the forms of cover shown in Figs. 14, 15 and 16 may be used. Fig. 14 represents an ordinary trench reinforced. It gives space for two ranks of men, one standing and one sitting. Fig. 15 represents a wider trench, affording more room and permitting freedom of communication. If a still more spacious cover is needed, the form indicated in Fig. 16 may be used. The cov-

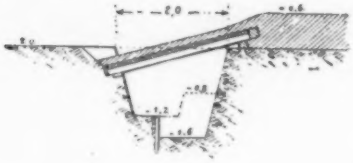

Fig. 14ª.

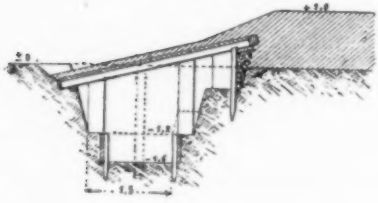

Fig. 15ª.

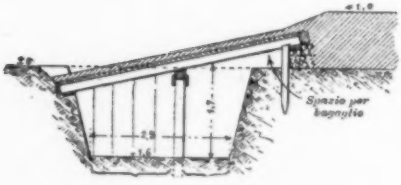

Fig. 16ª.

ering in Figs. 14 and 16 is made of tables or beams placed lengthwise and overlapping at the junctures if necessary. In trenches with head cover

Fig. 17ª

communication is afforded by means of passages in rear as indicated in Fig. 17.

Figure 18 represents a broad trench in which the firing position for men

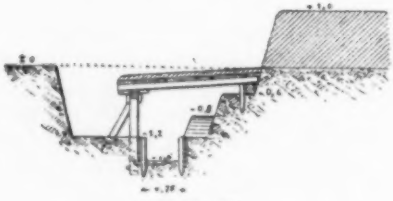

Fig. 18ª.

kneeling is retained and free communication is provided for. Sometimes cliffs or steep embankments may be utilized as cover for supports or reserves. In such cases the profile indicated in Fig. 18, or more simply that of Fig. 19, may be used. Such constructions are of great value during a

Fig. 19[a]

prolonged occupation.

In those parts of the trenches, such as a retired flank, exposed to enfilading fire, head cover is not constructed, but is placed in special defensive trenches parallel to the main line, as shown in Fig. 20.

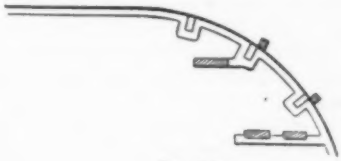

Fig. 20[a].

Minor intrenchments may also be prepared behind the traverses.

In sieges it will often be necessary to strengthen the parapet and the head cover. In addition to a more careful construction of the defensive works, it is well to give the supports more roomy accommodations and better protection from bad weather. To this end, the various wooden parts should be well united by means of hold-fasts, straps, etc., and the supporting beams should be firmly placed by sinking them in the ground or placing them on foundations. The cross-beams should be strengthened and all the apertures carefully covered.

The labor is greatly facilitated if metal plates are carried with the troops. These are described later.

OTHER CONSTRUCTIONS REQUIRED IN THE TRENCHES.

If the works are to be occupied for a length of time, their drainage, especially in the excavated portions, must be provided for. The digging of wells may also be necessary. Latrines must be constructed at some distance behind the works and connected with them by narrow ditches. Guide-posts and lanterns should be provided at necessary points within the works.

When the works are exposed to artillery fire it is necessary to maintain

a constant and also a secure outlook on the position of the enemy in order to guard against a sudden attack. Fig. 21 represents such an outlook, with

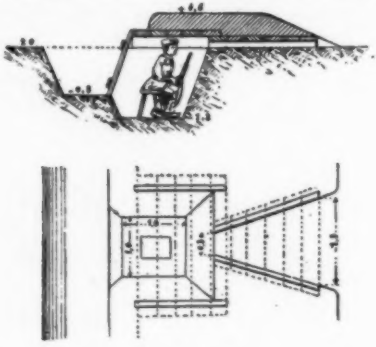

Fig. 21[a]

the necessary loop-hole for the observer. Mirrors may also be used for this purpose.

In sieges, the infantry may advantageously make use of shielded rapid-fire guns that may be moved by hand; to guard against sudden attacks, special rules are laid down for their use on the parapets.

After the question of infantry cover, the instructions treat of that for the field artillery, in which the artillery and engineer troops only are to be employed. The pioneers may be called upon for such work either after the artillery has begun the attack or during the defense. The same general principles obtain as in the case of the infantry. First the freedom of the field of fire must be considered, next the cover and the concealment of the pieces.

One of the first considerations will then be the necessary cover for the cannoneers. If time permits, cover should then be excavated for the pieces, unless the ground is dry or sandy, in which case the dust raised in firing would betray the position and cause the defense to forfeit the advantage obtained by

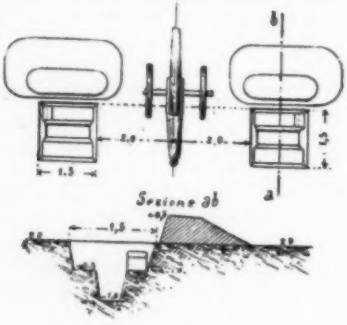

Fig. 22[a].

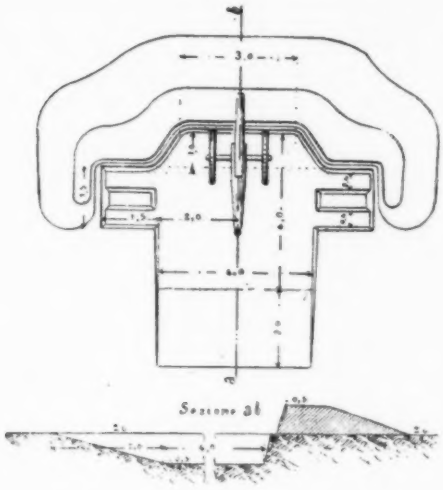

Fig. 23[a].

the use of smokeless powder. Imitation defenses, preferably constructed of earth, will serve to conceal the true position and attract the fire of the enemy. Types of the gun-pits to be used are shown in Figs. 22 and 23, but are not rigidly enforced.

If excavations, ditches, cliffs, etc., are found ready, they should be util-

Fig. 24[a].

ized as indicated in Fig. 24, giving to such cover a height of one metre.

In certain cases the single gun-pits may be united by a low parapet, in order to make them less conspicuous.

For fortress artillery the instructions provide constructions only for a battery, the pieces being separated by suitable traverses. Measures must be taken for securing the service of the ammunition. One of the first considerations will be the protection of the cannoneers against shrapnel fire. The parapets are to be given the thickness corresponding to the calibre of the pieces that will presumably be employed by the enemy. The settling of guns of large calibre must be provided for by suitable foundations. The batteries of heavy guns are placed in accordance with the principles already indicated. Howitzers and mortars should be placed, when possible, on reverse slopes, or under natural cover, to protect them against the direct fire of the attacker's artillery. The fortress artillery is arranged to fire by groups, the separate parts of which are connected by simple defensive trenches, in the same manner that the field artillery is utilized by brigade.

The second part of the instructions closes with rules for the utilization of ditches, sunken roads, hedges, dikes, palisades, fences, rails, iron gates, walls, etc., and also for the defense of woods, country houses, villages, railway stations, etc., as well as for the construction of redoubts and other artificial defenses. These rules contain little that is new except the maxim already emphasized, that the perimeter is not to be occupied. This rule is not given the importance which it perhaps merits, either on account of the changing conditions of modern warfare or the diversity of opinion on the subject. In the defense of villages, chateaux, etc., according to Lieutenant-Colonel Frobenius in the *Jahrbücher für die Deutsche Armee und Marine*, the solution offered by Captain De Guise is the best. If the defender, writes De Guise, has taken suitable precautions, removing easily inflammable objects, there will be little danger of conflagration from the effects of the artillery fire of the attack. A great expenditure of shells would be required in such cases to set fire to a group of houses, and therefore such objects afford good tactical *points d'appui* when exposed to field artillery alone. The circumstances change, however, when it is a question of dynamite shells from mortars, which, combining accuracy of fire with great efficacy, tend greatly to demoralize the defense when striking within such enclosed spaces. In such cases De Guise does not favor the occupation of the interior of these positions; nevertheless, their value is still considerable for the defense, as a cover for the reserves who are placed behind them and suitably intrenched. In this connection it is well to note the suggestion to establish an exterior line of defense, resting the flanks on the outer walls, and establishing positions for the reserves in rear, so as to enable them to readily deploy to meet the attack of the hostile infantry.

Lieutenant-Colonel Frobenius then adds: "In every case, the defensive arrangement of houses requires the greatest care, and it is surprising that the German instructions in field fortifications attach so little value to the defensive power of walls against direct artillery and infantry fire, neglect entirely the question of curved fire, and treat the question of the defensive arrangement of buildings in the same primitive manner as in the days of smooth-bore cannon. They deal at length with the defensive arrangement of walls, but without pointing out that a brick wall of the thickness of half a metre is *barely* sufficient as a protection against the fire of small-arms. The tables to follow sufficiently indicate this. Still worse are the French instructions, which say that walls resist the fire of infantry, but not that of artillery."

As to accessory artificial defenses, little that is new is to be noted except in the construction of wire entanglements. In making these, the stakes are to be placed irregularly as indicated in Fig. 25. The wires are also to be placed irregularly, a stout wire at about a hand's breadth above the ground being used to bind and support the stakes and a lighter wire (5 mm.) being woven between the stakes or attached to the thicker wire. Defenses of this character should be out of view of the enemy and should not impede the fire of the defense. If the configuration of the ground is not such as to conceal them, artificial cover should be constructed. Their maximum distance should be 50 metres from the line, so that they can be easily

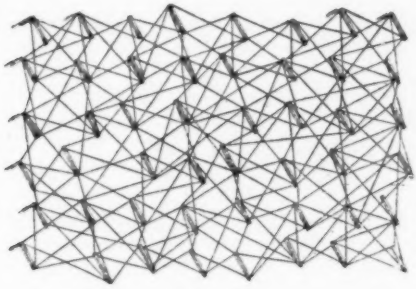

Fig. 25a.

observed at night and yet be exposed as little as possible to damage from the direct fire of the enemy.

As to the construction of redoubts, it has already been indicated that their use is exceptional. They are constructed for the use of the infantry only, and not for the artillery, and are ordinarily made for the accommodation of a single company. No special trace is prescribed, as this must be governed by the nature of the terrain and the configuration of the line of fire. Low redoubts are preferable, as being less conspicious. Low parapets, the absence of sharp angles, and the construction of abundant cover in such manner as not to impede the development of the firing line, are all to be considered. In certain cases the parapets must be strengthened and ditches in front are to be excavated, the latter serving as a cover for obstacles Head cover against shells from field-guns should be secured by materials already prepared.

In the third and last part, the instructions are devoted to the works of attack that are to be undertaken either by the infantry alone or in combination with the pioneers; to these latter troops is especially entrusted the destruction of accessory defenses and they are instructed in such work in time of peace. The destruction of such works by means of explosives, etc., is also the special task of the pioneers.

We find here a marked difference from the French instructions, which especially assign to the infantry the destruction of the accessory defenses; this is usually to be effected by the use of melinite.

The third part is concluded by the appendix No. 3, which treats of revetments, and No. 5, which gives the rules for a regular attack, and is for the special instruction of pioneer troops. Appendix No. 1 gives a list of the intrenching tools to be issued to the troops, and Appendix No. 2 gives the following data for the thickness of parapets.

AGAINST INFANTRY FIRE.

	Metres.
Land	.75
Ordinary earth	1.00
Swampy or wet ground	2.00

Snow, well packed	2.00
Sheaves of grain	5.00
Pine wood	1.00
Oak	.60
Steel plates	.02
Brick walls	.50
Boards reinforced by mortar	.20

AGAINST ARTILLERY FIRE.

Against the effects of shrapnel and fragments of shell.	*For field artillery.*
Earth	40 m. to 1 m.
Roofing beams	5 c. m.
For fortress artillery.	
Earth	1 m.
Roofing beams	10 c. m.

AGAINST SOLID SHOT OR UNEXPLODED SHELLS.

For field artillery.	
Earth	1 m. to 2 m.
Brick walls	1 m.
Snow	about 8 m.
For fortress artillery.	
Earth	3 m. to 4m.

The portion of Appendix No. 4 relating to the use of metal plates for cover is worthy of note.

Such cover may be constructed of any length required, and is made up of plates of one metre in length. Each arch is composed of two segments rivetted at the crown and weighing 98 kg. Each segment is supplied at the base with a section (⌐) rivetted on, and at the crown with a section (⊏) corresponding to that of the adjoining piece. Longitudinally, the parts are secured by overlapping, as shown in Fig. 26; while the union of the arches

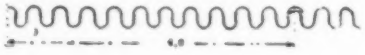

Fig. 26.

at the crown is secured by a clamp, as shown in Fig. 27. A frame, as shown

Fig. 27.

in Fig. 28, serves to support the arch and the longitudinal beams. (Fig. 29.)

Fig. 28ª.

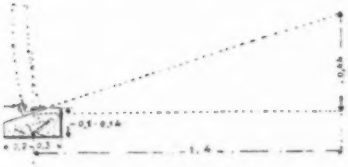

Fig. 29ª.

When the cover is relatively short, the plates are preferably disposed in directions normal to the parapet, as in Figs. 30, 31, and 32.

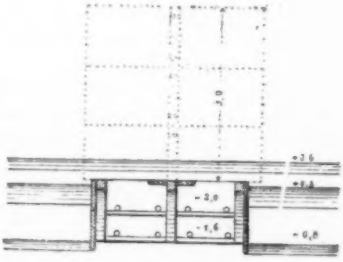

Fig. 30ª.

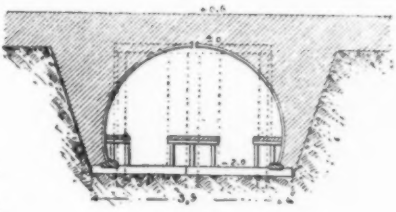

Fig. 31ª.

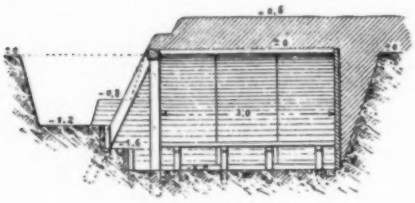

Fig. 32ª.

Layers of earth of .60 m. thickness as indicated in the drawing, are a sufficient protection against the direct fire of shells from field artillery This thickness may be increased, if necessary, up to 4 metres.

When a somewhat lengthy cover is to be constructed, it may be made in the direction of the ditch, in the manner indicated in Fig. 33.

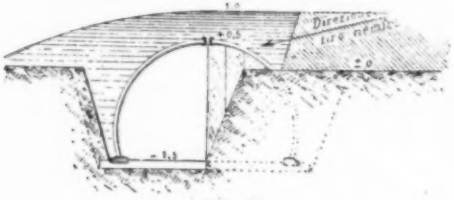

Fig. 33ª.

For the construction of cover of small dimensions a detachment of one non-commissioned officer and 12 men will suffice ; for larger constructions 2 non-commissioned officers and 20 men should be detailed.

In concluding, it may be said that these instructions open a new field of labor both for officers and men. Only by study and practice can effective defenses be constructed in the field, fulfilling the conditions of security and resemblance to the neighboring ground, and thus utilizing the value of smokeless powder. Instructions can only point out the way; their successful application in practice must depend on the troops.

It would be beyond the scope of this review to discuss the changes in the tactical principles underlying the art of field fortification as modified by these new German instructions. They undoubtedly mark a new era in field fortification and must in time exert a beneficial effect on other armies.

Military Notes.

ADMISSION TO THE ECOLE SUPERIEUR DE GUERRE, FRANCE.

Translated from the *Militär Wochenblatt* by LIEUT. CARL REICHMANN.

IN addition to the object of disseminating higher military instruction among the corps of officers, the special purpose of the Ecole superieur de guerre, as of the War Academy at Berlin, is to prepare officers of all arms for service in the general staff.

The Minister of War recently issued new instructions for 1894 regarding the requirements for entrance. These instructions give an interesting insight into the military scientific life of the French corps of officers and furnish much instructive comparison between French views and our own on that subject.

The candidate is admitted to the Ecole superieur, as to the Prussian War Academy, upon passing an examination to which captains and lieutenants of all arms are admitted. The first requirement is five years' service as an officer, of which at least three must have been passed in practical service with troops.

Officers seeking admission to the entrance examination, make application through their commanding officers. The first decision as to the admittance rests with the corps commander, to whom the commanding officer forwards the lists of candidates with notes on the personal and professional qualifications of the candidates. The corps commanders submit by August 15 of each year to the Minister of War the lists of candidates.

The examination, which with us is merely in writing under supervision, is much more extensive in the French army. It is divided into a written and oral examination. In addition all candidates have to submit to an examination as to their horsemanship.

The first part of the written examination is the preparation of a large sketch. This work is done after the fall manœuvres, in the vicinity of the garrison, under the direction and supervision of the commanding officer who determines the place and time. The sketch is a 4 kilometre route sketch with adjacent features, scale 1:20,000 elevation expressed by contours, drawing with colored pencils. The sketcher is on foot and not allowed to use outside means of assistance. We see that skill with the pencil is here placed in the foreground, while the existing Prussian regulations limit this art to the preparation of a simple sketch in a short time. The drawing of plans formerly required to be done at home, has lately been abolished.

The written examination takes place at corps headquarters on the last

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three days of January. Even the hours of the day for each branch are laid down beforehand once for all, as likewise all regulations are much more detailed than with us and bear the stamp of a strict formality. Thus, for instance, the paper for all written work, including the sketch, is furnished to the commanding generals by the War Minister from Paris. Each sheet is in a wrapper on which the candidate writes his rank and regiment, while on the sheet within, the work, without any note of identification, is to be placed. The work may only be done on the paper issued from Paris, sheets not used are to be collected and returned to the Minister of War.

The supervision of the written examination falls to the chief of staff of the army corps or, in his stead, to a staff officer specially detailed. The work is to be done under strict seclusion. Written or printed means of assistance are prohibited. The drawing materials to be used, are specially prescribed.

On the first day of examination a tactical problem is to be solved on the map in five hours. For the second day the answering of a question in army organization or war history as well as the working out of a problem in military administration is prescribed. Time allowed for the former is five hours, for the latter three hours. On the third and last day of examination, time allowed four hours, the preparation of a sketch on a certain scale from a map (reducing or enlarging) is required. This is immediately followed by a written translation of a French text into German. Time allowed two hours, use of dictionary forbidden.

The papers handed in by the candidates, including the sketch heretofore made on the ground, are sent to the Minister of War certified to as original. In the war ministry they are turned over to the president of the technical committee of the general staff, who marks each paper and its wrapper with the same number. The wrappers are then removed and locked up while the papers, on which the author's name does not appear, are turned over to the examination commission. This commission consists of the members of the technical committee of the general staff together with some generals and field officers of the several arms and administrative branches. The commission decides whether or not the author of each paper is worthy of admission to the oral examination.

The latter takes place at the Ecole superieur du guerre in the spring at a time specially prescribed. The examination commission is for this purpose divided into four sub-committees to whom are added the required numbers of civilian instructors. Corresponding to the division into four sub committees, the oral examination is divided into four groups:

1. Army organization, war history, tactics of infantry.
2. Tactics of cavalry, German language.
3. Artillery, fortification.
4. Geography, topography.

Lastly all candidates are again required to give proof of their horsemanship in Paris.

The extent of the requirements in each of the above mentioned branches is laid down in the programme once for all, by which are also measured the acquirements displayed in the written examination.

Under army organization an intelligent knowledge of the most important changes of organization in the French army from 1792 to 1815 is demanded as well as an accurate knowledge of the laws on national defense of France and a general knowledge of those of the German, Austrian, Russian and Italian armies.

For war history the study of the campaigns of 1796, 1800, 1805, 1806, 1807, 1809, 1813, 1814, 1854-55, 1859, 1866, 1870-71 and 1877-78, is specially prescribed. It is to be pointed out here that in the entrance examination to the Prussian war academy war history is omitted, while general history within narrow limits only is required.

The knowledge of the tactics of the three arms is to extend to the regulations and field service regulations of the infantry and cavalry, and to the regulations and most important firing regulations of the field artillery. Knowledge of the infantry rifle and its fire effect as well as the material of field, siege and fortress artillery is also required.

The subject of fortification comprises hasty, semi-permanent and permanent fortification and the most essential principles of attack and defense in fortress warfare.

In geography knowledge of non-European countries is not required, the military geography of France and the neighboring states is required. The candidates are expected to be able to explain the essential points by simple drawings in chalk on the blackboard.

In topography the essential principles of surveying and knowledge of the principal surveying instruments is required.

The candidates must be able to translate orally from the German into French and the reverse, to read fluently written and printed German text and write German from dictation without gross errors. In addition a knowledge of phrases most common in German conversation and especially of the most important military terms, is required.

BULLET EXPERIMENTS.

Dr. Victor Horsley, F.R.S., in a recent lecture at the Royal Institution said that he intended to consider what a cylindrical bullet with a conical end does in its flight, and what it does when it strikes an animal, so that one portion of his lecture would deal with physics and the other portion with pathology. Sometimes the wounds made were such that in some Continental wars or outbreaks the one side had charged the other with using explosive bullets. Melsens, a Belgian physicist, suggested the effect to be due to the compressed air in front of the bullet, and was supported by Laroque, of Lyons; this point was contested by Magnus, of Berlin. Dr. Horsley performed several experiments with the fall of projectiles through liquids differing in viscosity, to show that the theory of Melsens does not hold good. Huguier, a Frenchmen of science in 1848, suggested the hydrodynamic theory, which was established by Professor Kocher, of Berlin, in 1874-76. He—the lecturer—had found that it was due to two causes, the amount of fluidity of the solid and to the velocity of the bullet.

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The lecturer projected on the screen two photographic lantern pictures representing the effects produced by a bullet from the magazine rifle when it perforates a plate of iron a quarter of an inch thick.

In the first case, the bullet telescopes itself when it hits the plate; so makes a larger hole in its passage. Where it comes out of the same plate the hole is still larger, because it there tears open the iron, which at that surface has nothing but the air behind it for support. When, however, a bullet is fired into a wet, soft substance the conditions are different. When experimenting upon this latter point, he adopted a plan which had been previously in use, of firing a bullet into damp clay, and then filling the hole made by it with plaster of Paris, to obtain a cast of the result, which he found to vary largely with the amount of moisture in the clay. At the lecture he fired a magazine rifle bullet into a block of very damp clay, about two feet long by one foot square, and it made a bulbous hole about the size and form of an irregularly shaped Florence flask; then with a large knife he cut off the end of the block, revealing the hole, larger than a clenched hand, as if the bullet there had exploded. By means of plaster casts on the table he pointed out that when less wet clay was used the hole was smaller, and more of the shape of a soda water bottle, and with less water in the clay, still the hole was narrower, more nearly approaching an irregular tube in shape, but largest in the diameter near the further end. Sometimes there is a diversion of the bullet inside the clay from its original track, so that the casts are curved, which indicates the reason why surgeons, when probing, are sometimes unable to find the bullet. The greater the velocity of the bullet, the more destructive is it to the soft substance into which it enters. The "spin" of the bullet has little effect on the result. He concluded from these results that the magazine rifle is not a "humane weapon."

The speculation that some of the destructive effects of the bullet are due to the conversion of some of its energy into heat he did not consider to be of much moment; the heat produced is not sufficient to char particles of wool and hair carried in by the bullet. Microbes carried in by a bullet after passing through cloth can afterward be cultivated on gelatine, showing that they have not sustained a temperature above 40° C.

He next projected on the screen a picture that represented the effect of firing a magazine rifle bullet through each of two tin canisters, filled with an equal weight of lint; the relative size of the bullet is also shown. In the one canister the lint was dry, in the other it was thoroughly wet. In the first case the bullet simply perforated the arrangement; in the other the canister was hopelessly damaged, and much of the lint driven out in a kind of column at the top.

He then fired a bullet through dough containing 25 per cent. water, and but moderate explosive-like effect was produced. On next firing a bullet through flour containing twice as much water, the dough was scattered in all directions.

He then showed the distribution of the energy produced by the bullet in passing through water, by means of a trough arrangement with glass sides, closed at one end with a plate of iron and at the other with good India rub-

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ber, such as "heals" itself after the passage of a bullet. This trough contained an aqueous solution of a colored dye, up to a marked level. A sheet of white paper was suspended so that its lower edge just dipped into the dye. The point at which the bullet perforated the India rubber was three centimetres below the surface of the liquid.

The result was shown by the staining of the paper by the splashing up of the colored water, and shows that the distribution of the energy is about the same as when the bullet is fired into very wet clay.

Professor Horsley then passed to the pathological side of the subject, and described the experiments, by means of which he verified the deductions made from physical considerations. A dog, which, of course, was under ether, was arranged with apparatus to record by tracings the heart-beats, the blood pressures in the trunk-arteries, and the small capillary system, the movements of respiration, and the pressure within the skull. When a bullet entered the cranial cavity and set up the powerful hydrodynamic pressure referred to, the result was complete arrest of the respiration and a slight fall in the central blood pressure, which caused a similar fall in the peripheral pressure. Synchronously with the arrest of respiration there occurred a remarkable rise in the blood pressure, which continued till the normal tension was exceeded. This experiment shows that the first cause of death in such cases is not arrest of the heart and syncope, as the text-books affirm, seeing that the heart continues to beat. It is rather arrest of breathing, and if artificial respiration be quickly performed recovery from the otherwise fatal arrest may be obtained, as has been experimentally proved. The practical deduction from this fact is that with wounds in the head from rifles and revolvers the first thing to be done is to employ artificial respiration rather than to give stimulants. The physiological explanation of the phenomena observed is this. In the *medulla oblongata* is the chief centre for the movements of respiration, and also the centre and origin of the *vagus* nerve, which has the power of slowing the heart. There are thus two important centres liable to be affected by such changes of pressure around them as are induced when a bullet traverses the cerebral hemispheres. Supposing that the arrest of breathing has been removed by artificial respiration, there is another condition to be overcome, else death must ensue. The blood-vessels which have been lacerated by the bullet pour out blood which again raises the inter-cranial tension. This constitutes the second cause of death, for it again paralyzes the respiratory centre and slows the heart. To treat such hæmorrhage, however, only ordinary surgical measures are necessary, but these will be impossible if the activity of the respiratory centre has not previously been restored.—*Scientific American.*

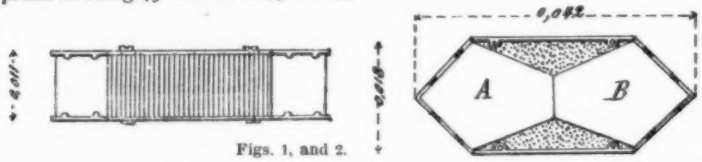
THE STROOBANTS PRISM-TELEMETER.

Translated from *La Belgique Militaire*, by LIEUT. J. C. BUSH.

This instrument consists of two small glass prisms, A. and B., placed base to base, as in Fig. 2, and inclosed in a light case.

Each prism has a right diedral angle at r (Figs. 3-4) but the opposite

angles v, which are cut off in order to save space, differ in value, that in prism A being 45° and in B 45°-22′-55″.



Figs. 1, and 2.

The faces of the right angles are alone uncovered; those forming the angles v are carefully silvered, and thus form two couples of mirrors protected by the case.

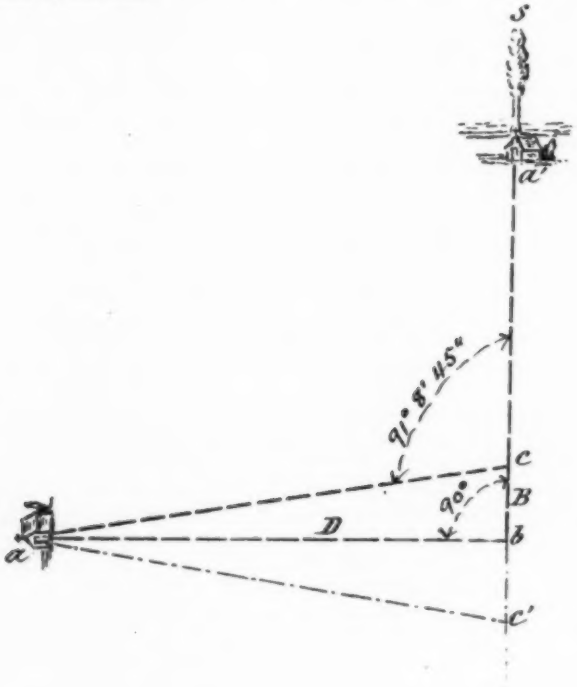


Fig. 6.

The prism A enables us to construct a right angle abs at the end of a line ab (Fig. 6).

The luminous ray from an object a (Fig. 3) enters the prism, is doubly reflected on the silvered faces and leaves the prism at right angle to its original direction, and therefore without refraction. The eye at O sees the object a in the direction ba', the angle aba' being 90°.

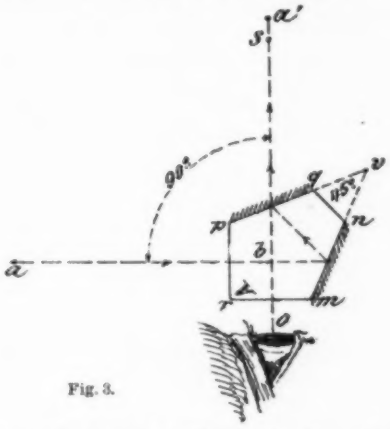


Fig. 3.

Practically a stake is driven at b (Fig. 6), the distance ab being the one we desire to measure. The observer at b takes the prism between the thumb and first finger, turns his body so that his left shoulder is towards a, revolves the prism A horizontally till the object a is seen by reflection. He

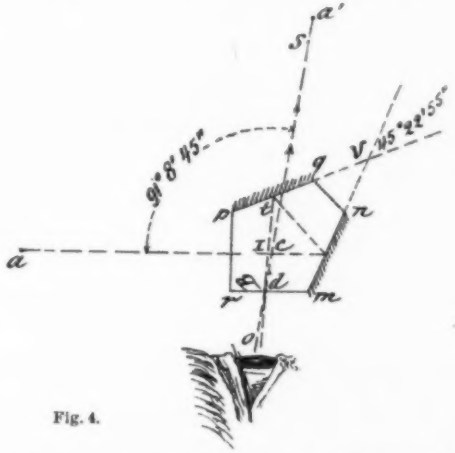


Fig. 4.

then glances over the case and causes a stake to be driven, or selects some object, in the direction which the object a appears by reflection. The angle aba' is 90°.

The prism B enables us to construct the angle 91°-8′-45″. The luminous ray enters as in the previous case perpendicular to the face rp and is doubly reflected by the silvered faces, so that the angle at I (Fig. 5) is $2 \times 45°$ 22′-55″ or 90°-45′-50″. As this ray does not leave the prism perpendicularly to the face rm, we must take into account the index of refraction—about 3/2. Hence rds (Fig. 5)=acs=90°+3/2(45′-50″)=91°-8′-45″.

Thus the eye placed at O sees the image of the object a in a direction

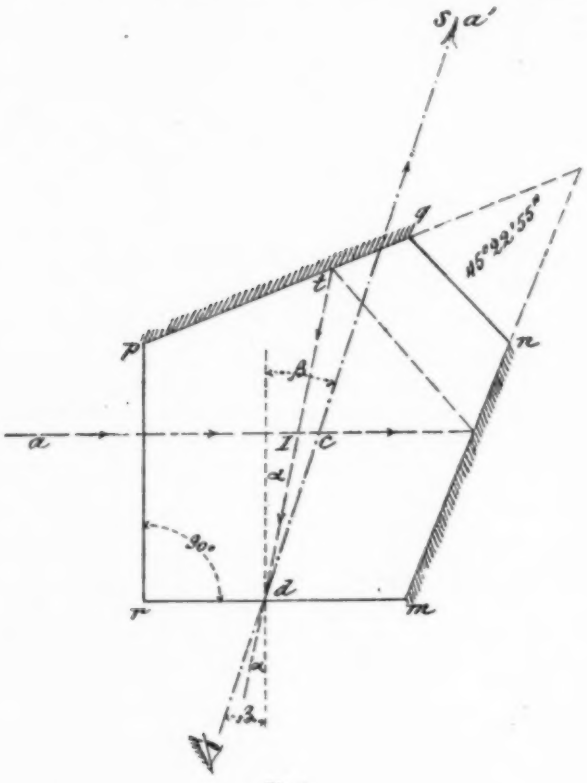


Fig. 5.

oa′ which makes with the incident ray ac an angle of 91°-8′-45″ and permits us to construct this angle.

The right angle having been determined as previously described (Fig. 6). the operator now turns the instrument end for end so as to bring the end B to the eye. He then advances along the line ba′ till at some point c, the reflected image of a, appears to coincide with the stake or object at a′, determined by glancing above the prism as before. The angle aca′ is 91°-8′-45″

The base bc is then measured, when the distance ab will be found equal to $50 \times bc$. $Ab = \frac{1 \times bc.}{\tan a}$ The angle a being 1°-8′-45″, its tangent is sensible $\frac{1}{50}$, hence $ab = 50 \times bc$.

The index of refraction may not be exactly 3/2 and in grinding the prisms a small error of one or two seconds may be made in the angles, which would effect the coefficient 50. In order to correct these errors the prisms are carefully tested and the exact coefficient determined and marked on the cover of each telemeter, as D=50.6 B for example.

The instrument is carried in a light case, on the cover of which the distances corresponding to the bases are tabulated.

The telemeter is only about 1½ inches long by ½ an inch thick, being smaller than the Souchier telemeter adopted by the Russian Government. It is accurate, simple, unalterable, easy to manage and quite inexpensive. It can be applied to a field glass in a manner similar to the Souchier by means of a cover to the object glass and a clamp.

ENGLISH WIRE GUNS.

Wire guns up to 12-inch calibre have recently been constructed, the 12-inch gun being 40 cal. long and weighing 50 tons. Four wire guns of 10′ cal. have been placed on the *Renown*; two other vessels of the same type are to receive 12″ guns of 40 cal. The chambers are constructed to receive a cordite charge. Specially tested, with satisfactory results, were the 7″ gun of 40 cal. Armstrong recently tested a conical breech block (screw) with good results. January 22d a section was screwed on to the muzzle of a 15 cm. gun, which increased the initial velocity to 1128 meters.—*The Militär Wochenblatt.* C. R.

FRENCH GUNS AND INFANTRY EQUIPMENT.

Wire guns are about to be introduced, and the 42 cm. guns are to be replaced by the 34 cm. gun, with the following data: length 42 calibres, weight 77 tons, number of grooves 102, charge 198 kgm., projectile 416 kgm., initial velocity 792 m. Three such guns have been placed on the *Brennus*. In the arsenal at Ruelle a 16 cm. gun of 90 cal. has been constructed experimentally by screwing together 3 sections of barrel; with a charge of 36 kgm. smokeless powder and a projectile weighing 44.5 kgm. an initial velocity of 1118 metres was obtained with a pressure of 2520 atmospheres. The 14 and 16 cm. guns are to be replaced by converted rapid firing guns of the same calibres. The length of the new guns to be manufactured, has been set down at 55 calibres. Extensive experiments with good results have been made with the 1 pounder automatic Maxim gun for torpedo boats.

Of the new field guns which are to be introduced—to be completed in 3 years at a cost of 324 million francs—it is reported that the shell of the 75 mm. gun will probably weigh 5-6 kgm., somewhat less than that of the present 80 mm. gun (6.5 kgm.). They admit of an increase in rapidity of fire up to 5 rounds per minute; the recoil is greatly diminished being almost entirely absorbed.

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The knapsack of the French infantry is to be altered and made lighter, and, as in Germany, the equipments are to be considerably lightened by the use of aluminum.

The infantry garrisoning fortified places is to be instructed in the service of the guns within a week after arrival; when there is no artillery stationed at the place, the instruction must be so complete, that the infantry can man the guns.—*The Militär Wochenblatt.* C. R.

REVOLVERS.

The 11 mm. revolver mod. 1874 has been replaced by the 8 mm. revolver mod. 1892. France. The old Enfield revolver is replaced in the cavalry by the lighter Webley revolver which carries a lighter bullet. England.—*The Militär Wochenblatt.*

GUIDE FOR JUDGING MEAT.

"Guide for judging meat and beef cattle." by Schwarznecker, corps veterinarian of the Guard Corps, Berlin.

Since the Minister of War has sanctioned the establishment of a regular course in garrison having their own butcher establishments, in order to give the administrative officials an opportunity to make themselves familiar with the general principles of meat inspections, the want of a guide for the instructor as well as for the pupils has become apparent. After citing the legal requirements, the inspection of beef on the hoof and on the block is discussed. The methods of preserving and adulterating meat, and especially indications of disease are treated in detail. The last part is a short treatise on the inspection of pork for trichina. The 6 tables represent parts of the beef showing the variations due to age and sex. The guide is recommended to the members of mess commissions and hospital inspectors. (Many a poor commissary officer in our service having a troublesome contractor to deal with, would be glad to have a short guide of this kind.)—*The Militär Wochenblatt.* C. R.

ATTACK OR DEFENSE.

At the Royal United Service Institution a lecture was delivered on the subject of "Attack or Defense Strategically and Tactically Considered," by Capt. Maude, late R. E.

Capt. Maude said: Since the War of 1870 and the era of improvement in fire-arms consequent thereon, a tendency, to use no stronger term, in favor of the defensive both as a strategical and tactical form of action, has made itself very conspicuous in contemporary British military literature, and this tendency seeks to buttress itself up with the traditions of the most glorious epoch in our military annals, viz., the Peninsular and Waterloo. But the conditions of war have altered very much since those days, more so, indeed than the weapons in use, the only factor to which this school appears to attach any importance. Breech-loaders and perfected shrapnel are certainly concrete facts with which we shall have to deal, but I submit that short service, the development of communications, the chronic state of peace as opposed to a chronic state of war, the spread of "book" education, and other factors which might be mentioned, all multiplied together altogether

overlay the influence exerted by changes in armament alone. There is only one condition that remains unaltered and unalterable, and that is the incidence of *Death*. The efficiency of an army is the product of the efficiency of its respective arms and branches, each of which is influenced by many factors. Men fighting on their own feet may make up in a variety of ways, by fanaticism, innate personal bravery, etc., for neglect of minor details of duty in peace time, but with the mounted services, particularly the cavalry, the horses reflect, with mathematical accuracy, the precise degree with which these minor duties have been carried out, always provided that the system on which these details are based is a correct one; but we have assumed the contending forces equal in all respects except in this one of duty, and therefore can confine ourselves to this point alone. Given equally good systems, the more punctilious discharge of duty will insure superior condition, superior mobility, and, finally, superior cohesion in the charge. The opposing cavalries will be face to face with each other in a few hours, but neither side has anything to gain by attacking immediately, for it is always the wisest plan to let a sleeping dog lie until you are prepared to deal with him. They will, therefore, for the moment form two opposing cordons, and since both will endeavor to keep touch with the other, any withdrawal on the one hand will be met by a corresponding advance on the other, and from day to day the line will assume an undulating character.

The advantage of the offensive in cavalry work can hardly be overrated. Minutes are then of more importance than hours to the infantry; lines of retreat are almost immaterial to them; you either win or you do not, defeat should mean disaster to the beaten side; and dead men do not trouble about lines of retreat. Now, in a great *initial* struggle, it will be as well to make sure of your bear before contracting to deliver the skin, and to sacrifice the probability of victory to its possible consequences would be the grossest conceivable error. This thrusts the *tactical* decision into the foreground; there will be time enough to reap the consequences of victory when the battle is won. This was not always the case, for reasons which are too obvious for investigation now. The unanimous testimony of Continental experts who have undergone the "ordeal by fire" is, that it is a very unpleasant experience indeed, and that the crash of bursting shells soon reduces the best of infantries to a condition of nervous prostration which renders futile any hope of accurate controlled fire action, and it must be remembered that since the introduction of rifled weapons, nothing approaching the intensity of modern artillery fire has been endured. The Germans, in 1870, had no reliable shrapnel. Their common shell was five times less effective, as an average, than the ordinary double walled shell, and still further behind the new high explosive ones in use all over the Continent. Further, not one battery in five, probably, had ever been really taught to shoot. So that the results actually obtained may everywhere be put down as a minimum. Yet some of these were striking enough. The duel between the eight guns on the Rotherberg against the 64th French line regiment behind a substantial intrenchment at 600 yards, and which ended in the defeat of the latter, is sufficiently suggestive, and Gnugge and Haas's batteries at St. Hubert are also instances to the point, and many

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more might be quoted if my space permitted. If, therefore, under the then existing conditions of projectiles and armaments, isolated batteries could hold their own under the most adverse circumstances of range against infantry under cover, how much more, therefore, may they be relied on to do so now when their power has increased at least tenfold, and that of the infantry in a far smaller ratio—but to that point I shall recur later. It has frequently been asserted in this country that on the whole there is nothing the infantry soldier enjoys more thoroughly than a good steady rain of shells, and the men who have made the assertion have been notorious for the highest personal gallantry. But there is always this trouble in dealing with the testimony of exceptionally brave men, viz., they are so abominably modest. It never occurs to them that they are different from other people, and because their nerves don't fail them amidst the lasting hail of the shrapnel bullets, they imagine that other people's don't fail either; but I submit that the bravest men of any army are by no means fair samples of the average man throughout that army, and that tactical forms and methods must be adapted to the general and not to the particular. However, I can afford to concede this point, viz., the moral effect of shell fire, also, provided they will allow that a dead man is not as efficient as a live one; that assumption will suffice me. For the consequences of this artillery preparation are certain to be bloodshed, more or less in proportion to the precision of the fire and its duration, and if by the time the infantry are sent in to the attack, some 20 per cent. on the other side are lying killed or disabled, then the task of the infantry will have been very materially lightened, for under equal conditions 80 rifles will not do as much work as 100.

For the regimental officer, everything hinges on bringing the men he personally commands up to the shortest possible range compatible with controlled fire. That range need not necessarily be the final range, and, in so far, it is not the decisive one. But it is *the* decisive one, in fact, notwithstanding, for if you do not attain the first fire superiority you will certainly never survive to reach the subsequent stages. When you, in the first line, have reached that first limit of the fire contest your work is done. You can coöperate with others as long as your life remains, but the direction of the fight has passed from your hands, and all that remains for you is to do your duty in that station of life unto which it has pleased the D. A. G. of the British army to call you. The responsibility for ultimate success, in so far as this first conflict has not decided it, now rests on the general and the arrangements that he, through his staff, has made for your support. If he possesses true battle genius—that indefinable gift of feeling the throbbing pulse of the immense fighting machine he controls, then at that precise moment when your strength was on the point of failing, and seconds would decide whether you turned and ran, your ear would have caught the beat of the drums, and if you turned the head your eyes would have seen the following line, closing always inward, and presenting a front which no wavering will could possibly have faced. You would—you will—gain a psychologic impulse from its strength, and go forward with a cheer till the enemy's fire again calls a halt to your progress, and so on. It is now a conflict between the battle instinct of the opposing leaders; all the individual,

of whatever rank, can do is to back this genius by all the resolution at his command, and all any regulation can accomplish is to train and steer that resolution. Resolution is will power, and discipline is only a Latin name for the resultant will power of thousands, willing the same purpose with all the strength of their natures; and the object of drill is to teach this will power, this sustained and concentrated effort of the mind, to control the muscles, both voluntary and involuntary, of the body; but to effect this the drill must be practised with smartness, and herein we have the scientific justification of the "cut away them hands there like lightning" of the drill sergeant.

To sum up the steps of my argument. Given two armies equal in all other respects, except in the national conception attaching to the word "duty," then that army in which duty is most highly developed will be ready for action first, and to utilize the gain of time must become the assailant. By the time it reaches the enemy's position its *psychological* superiority will have sensibly risen from causes already detailed. If in the Napoleonic era *la morale est pour les trois-quarts*, then in these days of smokeless powder and long-range weapons it counts for more, and hence the chances of success are markedly the greater. An incompetent commander may neutralize by his blunders the qualities of his troops, but these qualities, mainly the product of their national sense of duty, can extricate the commander, and, moreover, in proportion as the sense of duty is more or less developed in the race, the probabilities increase that incompetency will not be found in the higher ranks. Finally, under existing conditions of society, and for many generations to come, duty and loyalty are practically synonymous terms. The average man requires a concrete symbol on which to concentrate his attention, and that symbol for us is and remains the Crown; and in the era of warfare which is inexorably moving towards us I venture to predict that victory in the long run will incline to that nation which has remained true to a monarchical form of government. Philosophers may reason about and sacrifice themselves for abstractions, even for Humanity with a capital H, but the rank and file of the nation requires something more tangible.—*The Army and Navy Gazette.*

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Reviews and Exchanges.

A History of the United States Navy.*

PRESIDENT JEFFERSON'S idea of a navy was a gunboat or two comfortably skidded on the beach for long intervals of peace and pushed into the water when accidental intervals of war made it necessary. Even these operations were to be limited to defense, if in fact, any defense was advisable. Jefferson would rather adopt non-intercourse as a principle and in case of assault take to the woods.

The project is not quite so absurd as it looks, having enough vitality to crop up in these days as part of an ideal coast-defense system. Forts, we are told, have become useless because the enemy, like the Levite, will pass by on the other side. He will get in rear of them. He will cut them off. Better have a floating fort and then you can move it along somewhere else out of trouble.

This holding a marine adjunct in leading strings to shore quarters was not the way of the navy exhibited in "Maclay's History," and that is what makes the volume such pleasant reading. From the *Bon Homme Richard* to the *Kearsarge*, from Captain Sam Reid to Lieutenant Cushing, it is one continuous story of pluck, perseverance and skill that has fascinated, and will continue to fascinate, as long as courage and contrivance have a charm. Probably one of the first books read by every American boy was Cooper's "Naval Temple," and Hull and Decatur were as much fireside names as Old Put and mad Anthony Wayne.

In the work under consideration, the first volume of which has been published, the American boy of the future will have vastly the advantage. The main events are there in good type and paper worthy the subject and the detail is there which, if the boy skip, the student needs.

Plans and illustrations define the positions and fix the facts in memory, and the whole is so told that the landsman no less than the sailor can appreciate both the method and material.

There are three parts devoted to the War of the Revolution, the wars with France and Tripoli and the War of 1812, the conclusion of which, all of the Mexican War and the War of the Rebellion remain to be told in the second volume.

In the introduction is noted the curious circumstance that the official report of the commander of the *Shannon*, Captain Broke, to whom the *Chesapeake* surrendered, was a forgery. That officer for six days before and several weeks after the date of the report was unable to carry on a conversation except in monosyllables and totally unable to dictate or write an account of the action.

The report was actually a "concoction" of men who saw nothing of the fight and was not even submitted to the second in command at the time for any correction.

* "*A History of the United States Navy from 1775 to 1893.* By Edgar Stanton Maclay, A.M., with technical revision by Lt. Roy C. Smith, U. S. N. In two vols. Vol. I. New York: D. Appleton & Co., 1894

It appears too that Washington, like Bonaparte, incurred the possibility of becoming an English midshipman. These "might-have-beens" open up wonderful speculations. It was the boat of Amyclas that carried Cæsar and his fortunes, but what of the ship that might have held an Admiral Washington, Captain Nelson and Lieutenant Bonaparte? It was well that two of these gentlemen found occupation for their abilities elsewhere than under the meteor flag.

If not a military, the United States were a maritime nation from the start. Fisheries and a coastwise trade pursued in face of danger from pirate and savage in armed vessels and with trained crews formed the school in which were educated the seamen of 1812.

So early as 1645 the Barbary rovers were given a lesson in Yankee vigilance and daring and in the wars of the 17th century colonial enterprise, reaped a large reward of experience, at least, contributing against the enemies of England "between 3 and 4 hundred privateers."

But it is hard to discover anything attractive in naval life for the English seaman of old days. The brutality of their treatment is stated to have been "almost beyond belief." An instance is given of 300 lashes through the fleet, and imprisonment for one year for the alleged crime of stealing a handkerchief. At this rate what would be an adequate punishment for the present fashionable crime of stealing a railroad train or for that matter the railroad itself."

Impressment and flogging might well have brought on the mutiny of the Nore but that explosion was rather due to foul and scant food and misapplied pay.

The articles of war of the American navy prior to 1812, declare that not more than 12 lashes shall be given for a crime.

Not only very much improved discipline but superior seamanship contributed to the success of the American navy. "Let the quarter-deck look out for the colors and we'll look after the guns," was the word of the crew, and the chase of the *Constitution* showed that the quarter deck was as fertile in expedients as the forecastle in courage.

A pleasant story is told of an inspection of the *Constitution* by a distinguished officer of the Royal Navy. "This," said he, "is one of the finest frigates, if not the finest, I ever put my foot aboard of, but, if I must find fault, I'll just say that your wheel is one of the clumsiest things I ever saw."

"That wheel," replied the American captain, "is the only English thing in the ship. When we captured the *Java* our wheel was knocked into splinters by a shot from the Englishman and after the engagement the *Java's* wheel was fitted and though we think it ugly we keep it as a trophy."

Paul Jones takes up a good deal of space and deserves it all. With a commission issued directly by the American Congress and duly appointed to his ship and squadron by Franklin under authority of Congress he nearly completed the circuit of the British coast, captured some seventeen vessels and set the frightened people to burying their plate and valuables from Cape Wrath to Flamborough Head.

Mr. Kipling seems to have written his "spirited but inaccurate" "Rhyme of the Three Captains" in a fit of indigestion. At all events he is very severe on our Commodore Paul—calls him a pirate, and as skipper of a trading brig vociferates through a page or more of "He has"—and "Had I's"—greatly to the disparagement of the "Yank Yahoo." Something must be forgiven to poetic license and lyrical impetus when Sir Joseph Yorke, the British ambassador to Holland, seduced by no metrical illusions, could in cold blood write down the American officer "a rebel subject and criminal of the state."

There is nothing in the record of British exploits, long and bright as it is, that surpasses the story of Paul Jones and his ship. Summoned by the British commander

after an hour's desperate work to know if he had surrendered the only reply is that he had not b:gun to fight. The table of comparative force and loss is remarkable :

	Guns.	Lbs.	Crew.	Killed.	Wounded.	Total.
American.....	42	557	304	49	67	116
British	50	600	320	49	68	117

The cenotaph in Trinity churchyard at the head of Wall Street is, it appears, sacred to the memory of some ten thousand prisoners who perished in the hulks of Wallabout Bay. They were mostly captured privateersmen, and from their number some estimate can be formed of the damage inflicted upon British commerce in the Revolutionary War.

The treatment of these men is well described as one of the dark chapters in the history of England, who never seems to have lacked in the background a convenient supply of Sir Hudson Lowes.

Of continental vessels lost during the war by capture, wreck, etc., there were 24 as against a loss of war vessels to the British of over a hundred. The total capture by the Americans was about eight hundred.

Fourteen years after the joint capture of the Yorktown redoubts by Hamilton and Lafayette, French depredation on our commerce had become so persistent that great irritation existed, and in 1798 all French treaties were abrogated and a naval war against France begun, lasting two years and a half, in which 84 French armed vessels, mostly privateers and mounting over 500 guns, were captured, and the new American frigates, built with special reference to speed and superior armament, were tried and found to answer.

The *Constitution* won in an all day race the wager of a cask of wine from the captain of an English cruiser, reported to be one of the best sailors in the West Indies. But Isaac Hull was the 1st lieutenant and navigator.

Close upon the settlement of the difficulties with France followed the war with Tripoli, of whose piratical habits the English as usual took the purely disinterested view.

"It will not," said Lord Sheffield, "be to the interest of any of the great maritime powers to protect America from the Barbary states." But America undertook her own protection, and a squadron of three frigates and a schooner put in an appearance on the Mediterranean in July, 1801. Lieutenant Skerrett, appropriately of the *Enterprise*, began the business with such energy and success that the Tripolitans took to shore duty, and in the following year the American fleet was largely increased.

In 1804 Captain Preble arrived and introduced himself to "His Britannic Majesty's 84-gun ship-of-the-line *Donegan*, Sir Richard Strachan," in a very characteristic manner, for the details of which the book must be consulted. Probably this was the very Sir Richard of the famous couplet which so picturesquely sets forth the customary results of army and navy coöperation in all times as in the Walcheren expedition :

> "Great Chatham's son with sabre drawn
> Stood waiting for Sir Richard Strachan,
> Sir Richard, eager to get at 'em,
> Stood waiting for the Earl of Chatham."

but the fever waited for nobody. The grounding of the *Philadelphia*, her subsequent destruction and the bombardment can be read with no less admiration now than nearly a hundred years ago, when Nelson pronounced the work to be "the most bold and daring act of the age."

The American fleet having grown to some thirteen vessels, Tunis was also tamed, Captain John Rogers giving the Bey a day and a half to come to terms. Instead of

tribute from the United States a minister from Tunis embarked on the *Congress* and was duly delivered at Washington.

"The young republic by means of its navy had thrown off the yoke of the piratical Barbary powers and frustrated the intrigues of Great Britain," who was next to be taken in hand as is set forth in Part 3 which concludes the 1st volume.

When the United States began its struggle for "Free Trade and Sailors rights" the disparity of force was enormous.

	Ships.	Tons.	Guns.	Men.
United States.....	17	15,300	442	5025
Great Britain.....	.1048	860,990	27,800	151,572

and the same disproportion existed between facilities for building, arming, equipping and refitting ships of war.

The free trade of those days was not the glittering generality which sheds a baleful glare over domestic manufacture or gilds with golden light the long bank accounts of corporations and monopolists, according as you give your confidence to the *Tribune* or the *Times*, but it meant the very practical declaration *hands off*, non-interference with neutral commerce, and the navy had to fight for permission to go to sea, the policy being to keep vessels at home for fear of capture by the vastly superior numbers of the enemy. But Bainbridge and Hull and Stewart and others did not look at things that way. They had their wish and results justified the bolder course as they generally have done and will do hereafter. Into the details of the victorious career of frigate, sloop and Lake fleet it is hardly necessary to go. The London *Times* summed up such part of the story as it had then heard, "Five hundred British vessels captured in seven months by the Americans! Five hundred merchantmen and three frigates! Can these statements be true?"

The affair of the *Chesapeake* and the *Shannon* afforded and continues to afford John Bull great consolation which there is no need to dilute. The *Shannon* was otherwise ill-fortuned. There were three of them, one wrecked in 1800, another built and lost that same year and the third, our *Shannon*, broken up after the war, while the timbers of the captured *Chesapeake* were used to build a flour mill at Wickham and were visited by the biographer of Sir Philip Broke in 1864, whose very pleasant account of the "merry-going" mill closes chapter 7.

Peace hath her victories, we all know, and at the opening of the Erie Canal the guns of Perry's squadron echoed the proverb, "placed along the whole line of the new waterway about ten miles apart and when the first fleet of boats left Buffalo the fact was literally announced in thunder tones in one hour and twenty minutes to the citizens of New York by a serial discharge of these guns." The skeptic thinks of Washington's cherry-tree and shakes his head. From Buffalo to Sandy Hook is some 520 miles by way of Albany. Perry had 54 guns all told, 42 of them thirty-two pounders. Ten miles in ordinary weather and over average country seems a large radius for the sound wave of a solitary gun of that calibre even when shotted.

There is however a more extended notice which we transcribe from Sargent's "Public Men and Events" for the benefit of the doubting Thomas at our elbow.

"The completion of the canal, and the letting in of the waters of the lake, took place on the27th of October, 1825. Cannon had been placed at suitable distances from Buffalo to Sandy Hook, and upon the letting in of the waters the gun at Buffalo was fired, and the next, as soon as the report of the first was heard, and so on to Sandy Hook, thus announcing the important event. The first gun was fired at ten o'clock A. M. and the gladsome sound reached New York at twenty minutes past eleven. The cannon, when their boom had reached Sandy Hook, were fired in reversed order, one extremity thus replying to the other.

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"Simultaneously with the letting in of the waters at Buffalo boats gayly decorated and drawn by four and six horses started for New York. They were joined by others, similarly decorated and drawn, at Rochester, Syracuse, Utica, and other principal towns on the canal, and these formed quite a fleet by the time they reached Albany. Here they entered the North or Hudson River, and were towed down by a fleet of steamers, the whole presenting a most animating scene. There was the *Seneca Chief* from Buffalo, the *Niagara* from Black Rock, and the *Young Lion from the West* from Rochester. With the fleet from Albany came Governor De Witt Clinton, to whom the canal owed its existence. This fleet was met above New York and escorted to the city by another fleet of steamers, decorated with flags and streamers, arriving about nine o'clock A. M. on the fourth of November. At a given signal all the vessels and forts in the harbor were ornamented with flags and a grand salute was fired. The fleet consisting of twenty-one steamers with several large vessels in tow besides the boats that had come through the canal, proceeded down the bay to Sandy Hook amidst the roar of cannon.

"On arriving at the 'Hook' Governor Clinton united lake and sea, by pouring a keg of the waters of Erie into the Atlantic."

Volume I concludes with the account of Porter's cruise in the Pacific and his capture by the "cautious attack" of the British vessels, *Phœbe* and *Cherub*, after a long range cannonade of over two hours in the neutral waters of Valparaiso.

But the *Essex* had meanwhile disposed of "4000 tons of shipping, taken 400 prisoners and annihilated British commerce in that part of the globe," and in this cruise of Capt. Porter began that record of Midshipman Farragut which terminated so gloriously at Mobile Bay.

Not often does there fall to one life at the ages of 11 and 61 illustrations of the highest qualities that can adorn service by land or sea such as were displayed on the decks of the *Essex* in 1814 and of the *Hartford* in 1864.

H. W. C.

Cavalry Life.*

This is not a story of stirring charges nor of forced marches in pursuit of the elusive savage: nevertheless, the elements of adventure and privation are not wanting to make the book a notable and, in some respects, a unique contribution to American military literature.

Mrs. Boyd has but few predecessors in authorship among the ladies of our army. Many years ago "Following the Drum" shed a side light upon the domestic life of the "Old Army"; then a long interval of silence was followed by "Boots and Saddles," "Tenting on the Plains" and "Recollections of a Soldier's Wife"; while the biographies of General Hancock and other distinguished officers, written by their devoted widows, have further enriched the annals of the service with respect to, what may be truly called, the better half of the army.

And the theme is by no means threadbare, as may be said of much that is printed under the head of personal recollections. The veteran may become prosy and his auditors weary as he dwells on the sanguinary details of the days of '46 and '61; but the memories of wifely and maternal sacrifice are like "the old, old story" ever fresh and fraught with interest to men and women everywhere.

This "Cavalry Life," covers not only the author's experience as an officer's wife in Nevada, California, Arizona, New Mexico and Texas from 1868 to 1885, but also includes a remarkable chapter of unmerited misfortune, of terrible injustice, of manly fortitude, culminating in a providential interposition which brought vindication and

* *Cavalry Life in Tent and Field.* By Mrs. Orsemus Bronson Boyd. New York: J. S. Tait & Sons. 1894.

atonement. There are vivid descriptions of scenery ; of frontier travel ; of garrison life—from a one company post, to Fort Clark with two regiments assembled; of frontier housekeeping ; of lavish hospitality and weeks of gayety, followed, in the vicissitudes of cavalry service, by months of isolation and lack of the commonest comforts of civilization ; of patience, pluck and buoyancy of spirit under trials calculated to break down the average woman.

Mrs. Boyd has not confined her observations to things exclusively personal, but now and then comments very sensibly upon matters professional. Her introduction to garrison life was just after our Civil War, when discipline, in some of the new regiments, was very irregularly enforced ; of this she says :

"As everything in the life I then led was new and strange, and surroundings have always powerfully influenced me, I took note of many things which it seemed should have been remedied. One which greatly troubled me was the power extremely young officers exercised over enlisted men. If the latter were in the least unruly, most fearful punishment awaited them, which in my opinion was not commensurate with the offence, but depended entirely upon the mercy and justice of the offender's superior officer, who usually but a boy himself had most rigid ideas of discipline. I had always noticed how years temper judgment with any one in authority, and thus have come to believe that no very young man is capable of wielding it."

The author had her share of trouble with the servant problem which was solved for her as it has so often been for the army sisterhood by the much abused but invaluable "striker."

"I always have had and always shall have a tender, sympathetic feeling for American soldiers. In fact most of the kindly help which made life on the frontier endurable to me came from these men. * * * To cook in a modern kitchen or even in an ancient one is not so dreadful ; but to cook amid the discomforts and inconveniences which surrounded me for many years, would have been impossible for any delicately nurtured woman. I recall the delight with which an offer of help from a soldier in that, my first effort at housekeeping, was welcomed. * * * The greatest proof of devotion I ever received was when that man, learning that the laundress declined longer employing her services in our behalf, saw me preparing to essay the task myself. To prevent that he rose sufficiently early to do the work and continued the practice so long as he remained there despite the fact that it subjected him to ridicule from other soldiers ; and so sensitive was he in regard to the subject that I never unexpectedly entered the kitchen while he was ironing without noticing his endeavors to hastily remove all trace of such occupation."

Upon a change of station to Arizona and New Mexico the only servant who could be induced to go with them was a Chinese boy aged 12 ; and the author says "it is to this day an historical fact that we took the first Chinaman into those States which now swarm with them."

One of the many perilous experiences of the author was when in company with her husband and three-weeks-old baby they rather recklessly ventured to pass, without reasonable escort, through a region infested by the Apaches.

"I now see that we were then too young and inexperienced to realize the dangers of our terrible position. It was however soon understood and before entering the cañon, at six o'clock that evening, all warlike preparations possible under the circumstances had been made. A civilian had joined our party at Fort Mojave, and thus there were three outriders. The two sabres in our wagon overhead we took down and unsheathed, so that, when thrust out on either side, there seemed to be four weapons—at least we hoped the Indians would think so, and unless they came very close, the dim light would favor our deception. The gun was placed so it could be used at a moment's notice. I held one pistol and Mr. Boyd the other. The soldiers, with their bayonets bristling, looked as warlike as possible ; and altogether we relied upon what eventually saved our lives—our appearance of strength which we in no wise possessed. We had been told that the Indians, at least in that region, never attacked unless confident of victory ; and we knew that unless they were directly beside us, the appearance our wagon presented, so covered they could not see its interior, and seemingly full of

weapons, would indicate a well-armed party of men. Instead there was one man handicapped by the care of his team and the helpless nature of his charges—a feeble woman, an infant, and a diminutive heathen, who on perceiving the active preparations being made for resisting what he had so feared, became literally green with terror and altogether useless. The cañon was so precipitous on both sides that we seemed to be travelling between two high walls. The entire region was weird and awful. * * * We had proceeded some little distance and were feeling considerably relieved, when suddenly a fearful Indian war-whoop arose. * * * I had only sufficient consciousness to wonder when we should die and how."

The readers of the JOURNAL are referred to the book for what followed. It is sufficient to say that the travellers escaped death, although on the very next day a well-armed party of freighters was attacked on the same spot and lost one man killed.

The tragic element of the book is fully treated in the preface by the author and in the appendix by the well-known writer, Colonel Savage, a class-mate of Captain Boyd. The volume is very agreeably "rounded up" by a chapter entitled "American Civilization, as Viewed by Weeping Wensel, late Chief of the Kiowas": a humorous lecture delivered by Captain Boyd on several occasions before large audiences for charitable purposes.

The volume is a well printed duodecimo of nearly 400 pages and deserves a place in every American library, among the books to be read and preserved.

T. F. R.

The Principles of Strategy.*

The author is already known to us as the writer of Mars-la-Tour and Gravelotte and needs no introduction. The appearance of the second edition of his work bears additional testimony to the fact, that professional study which for years after the war was drooping under the conditions imposed by the nature of the service, has begun, not only to spread, but to furnish us with a military literature of our own.

The field covered by strategy is a vast one, including as it does not only everything comprised in the art of war, but the entire national life, national characteristics, politics, military policy and institutions, industry and commerce. All of these elements with their numerous branches admit of discussion under their philosophical, theoretical and material aspects and they will always form hard reading. In undertaking to extract the underlying principles of all of them and condensing them in one work, the author has set himself no small task, the more as we are given to understand in the preface that the work is intended for the professional and lay reader alike.

To assist the latter the author gives in the first chapter a number of definitions. War is defined as a contest between nations, states or parts of states carried on by force; we should prefer to adopt the definition that war is a continuation of politics with sword in hand, as is most aptly illustrated by our own wars.

On the second page of the text we already encounter the system of subtile classification which we meet in all dogmatic works. Tactical and strategical points are subdivided into "key" points and "decisive" points. In this instance the author runs counter to the universal custom by applying the term "decisive point" to what is the world over called the "key" of a position. It is difficult to see an advantage in these nice subdivisions; they no doubt are of assistance to an author, but they convey nothing new to the professional and do certainly not lighten the task of the lay reader. There is danger in being too scientific, for the layman, in that he may mistake knowledge of a number of scientific terms for science, and also for the professional, as we may learn from the nature of the Prussian army in its disastrous campaign in 1806.

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* *The Principles of Strategy.* By Captain John Bigelow, Jr., 10th Cavalry. Second edition. J. B. Lippincott Company. Philadelphia, Pa.

The offensive and defensive we think should have been entitled to more space; they are not treated separately elsewhere in the book; the superiority of the offensive in *morale* is not pointedly enough stated, nor is it brought out that on the material superiority of the defensive the second great principle of applied strategy is based; "for the decisive action one can never be too strong."

An army on the march is the subject of the second chapter. The author discusses first the march in an uncivilized country and the formations adopted by Napoleon in Egypt and by the British in the recent Soudan campaign. Here in our opinion the author becomes too artificial in distinguishing between "ordinary" or "tactical," and "grand" or "strategic," squares. We venture the assertion, that squares are tactical formations pure and simple for purposes of local attack and defense and that their use on the march does give them a strategic character.

The functions of the advanced guard in a civilized country are then briefly discussed, and the order of march of troops and their trains of a division 15,000 strong. The author then takes up the efficiency of command and administration which he dismisses with a few words. This is to be regretted. Efficiency of command and administration come under the heading of organization, one of the weightiest elements in strategy. Its potent influence, moral and material, deserves extended discussion and we believe the author would have done a good service to the public at large by exploding the too common idea, that an aggregation of armed men is an army, and by pointing out the weakness of our national defense as well as of our regular army, however excellent the latter may be in other respects, owing to the lack of proper organization. We think the subject should have been separately treated in a chapter preceding that of an army on the march.

Celerity of movement is next discussed. On page 35 the requirements of a marching order are hinted at. In view of the paramount importance of the subject of orders we would propose, if we be allowed to make a suggestion, that the author insert, perhaps in a foot note, a model marching order as an object lesson.

Organization and size of armies is the heading of the next chapter. The author confines himself to a very brief statement as to the numerical strength of the division and corps, and grouping of armies. Of organization itself he says practically nothing and we are confronted rather with its results. On the subject of organization we have already expressed ourselves.

The author then quotes from Derrecagaix on march fronts and combat fronts in connection with the size of armies. It might be well for the reader to bear in mind that the distances laid down, although entirely within the power of an army marching in this country, require a greater expenditure of physical strength than Derrecagaix contemplates, owing to the difference in quality between our roads and those in France and Central Europe.

In what is stated of intrenched camps under "second line" we are reminded of the conditions existing on the frontiers of France, Germany and Russia.

In the next chapter, entitled the strategic chessboard, the author assigns to topographical features their coefficient for strategic purposes. There are few writers on the subject of war or strategy that have not made a comparison between war and the game of chess in one way or another. There is hardly any other term that so nearly expresses the variety of combinations offered by the theatre of war, as the term used here by the author. But the game of chess differs from war in this that it offers a far greater variety of combinations and chances than war, and in that it is not influenced by human nature, nor by "Providence guiding the destinies of mankind." We should prefer not to see the term chess used even in the limited sense in which the author uses it, as the mere use of the term is apt to give to the picture, which the reader forms

or has formed of war, a tone which is equally foreign to its nature and to the author's intention.

The author then proceeds to the definition of strategic points and goes into a systematic arrangement of the same which, however good, we consider far too minute. We fail to see why points should be considered decisive in strategy on account of "sacred or historic associations." If such reasons gave strategic importance formerly, they certainly do not now at the close of the 19th century when war has become altogether too unromantic to deal with sentimentality. With all due reverence for the father of our country, we cannot, by any stretch of imagination, conceive Mount Vernon as a decisive strategic point or strategic point of any kind. This reminds us of Carlo Alberto marching on Rivoli in 1848 because fifty years before Napoleon said once that whoever possessed the plateau of Rivoli, was master of Italy. Carlo Alberto was promptly defeated by Radetzky.

The author next takes up obstacles which he discusses with special reference to our own topography and frontiers. The obstacles are divided into natural and artificial obstacles. Among the former are enumerated neutral territory, oceans, deserts, mountains, forests, inland seas and lakes, swamps and marshes, and rivers. The character of each in its military bearing is stated and means indicated for overcoming the obstacles.

Among the artificial obstacles are enumerated inundations and fortifications, the latter subdivided into forts, fortresses, intrenched camps and bridge heads. The subject of screens (woods, mountains, mist and darkness) and the use of screens and obstacles is next taken up and well illustrated by instances from our own wars.

The author then discusses communication and transportation by road, rail and water, giving the capacity of each kind and illustrating same by historical instances and pointing out the magnitude of rail and river transportation during the Civil War. The organization of the lines of communication is not discussed. The chapter terminates with a short outline of the obstruction of rivers.

The next chapter treats of "the essential elements of strategy." The author states: "Every operation of strategy consists essentially in a movement upon an objective under one of the three following conditions:

"1. The enemy is moving upon the same objective, in which case we have a race.

"2. The enemy is covering the objective, in which case we have a manœuvre.

"3. The enemy is himself the objective, in which case we have a simple advance or pursuit, according as the enemy stands his ground or retires." The first and second cases are illustrated by mathematical demonstrations. The two factors, time and space, the author states, are so dependent upon local considerations, that the deductions of geometrical discussion cannot be applied until corrected for practical features of each individual case.

Concentrated retreat and pursuit are illustrated in the next chapter by a brief sketch of the Atlanta campaign.

In the 7th chapter we are introduced to three different kinds of strategy:

"1. Strategy proper, or regular strategy, which aims at depriving the enemy of his supplies.

"2. Tactical strategy, which aims at overmatching him on the field of battle.

"3. Political strategy, which aims at embarrassing his government."

After a short reference to the War of the Revolution and that of 1812, we are informed of the author's reason for this subdivision of strategy; page 109 he says: "It is with a view to bringing better men than the enemy's upon the field of battle that the general practices regular strategy. He aims at fighting half-fed, half-clothed, half-armed men with men that are well off in each of these respects. It is with a view to

overpowering the enemy before meeting him that he practices tactical strategy. By the practice of political strategy he aims at undermining the political support of the opposing army, or at effecting its recall from the war."

We would place tactical strategy first in order: however much "regular strategy" and "political strategy" may cripple an enemy, the loss of a decisive battle will cripple him more, it opens the gates to his country and offers the best of opportunities for applying to him "regular" and "political" strategy, while at the same time preventing him from making use of the same means. Barring a blockade by fleet, "regular" and "political" strategy can barely be said to come into play until after a decisive battle. They are after all but auxiliaries in the foremost task of strategy, which is the destruction of the enemy's field armies.

In the next chapter we are made acquainted with the subjects of communications and base. The author explains the relations to each other of lines of operation, of supply, of retreat, the troops necessary to guard them and the influence of the conformation of the base, and points out how the command of the sea gave the Federals liberty during the campaign in Virginia to establish their bases or depots at will. Fig. 24, page 112, the smaller the angle under which the lines of supply and retreat join the line of operation, the greater is the margin of safety. As illustration Grant's overland campaign is given in the next chapter.

The next subject is that of operating independently of a base which is treated under three heads.

1. Supplies being carried along.
2. Supplies being taken from the country.
3. A combination of the two.

Under the first head is discussed the method of disabling an enemy who is rash enough to commit himself to an expedition carrying all his supplies with him and who is without absolute certainty of finding new supplies at his objective, be that a rich district or a depot or base of his own side.

It is safe to say that a whole army will never resort to this kind of operation except for the purpose of effecting a change of base. Of sustained operations an army relying wholly on what supplies it carries along, is incapable from the beginning, and must collapse if opposed and delayed by the enemy beyond a certain time. This method will therefore find its principal application in punitive expeditions against savages, in civilized warfare for minor expeditions.

Under the second head the author states the facilities and difficulties of requisitioning and foraging in different kinds of country.

The third case is again only safe and practicable when the army is certain of a new base.

The 11th chapter is entitled "Operating from a base." It might have been well to show why a secure base and communication with it is an indispensable requisite for an army which is to engage in sustained operations. In the illustration on page 153, the army A is operating from a point on the directrix of army B. The most brilliant results have been obtained where A started from a base at an angle to B's base. Where A starts as in illustration, he has always been defeated by an alert enemy. The author speaks of the one whose communications have been cut, as on the defensive; if he allow himself to be thrown on the defensive in such a case, he is indeed already half beaten. What he needs is the most vigorous kind of offensive, for whoever turns the enemy may be himself turned, and whoever snatches the initiative from the opponent, other things being equal, ought to triumph.

Washington's counter-offensive at Trenton in 1777 and the campaign of Chancellorsville in 1863 are cited to illustrate the manner in which communications may be re-

covered, when cut or threatened by the enemy. The Chancellorsville campaign is but one of many instances which go to show that he who turns the enemy, is himself turned, and that if he cannot force the enemy to the defensive, he is apt to be himself defeated. Hooker's strategy up to the time of reaching Chancellorsville, is brilliant, after that it sinks to the level of the thirty years war; his opponent correctly estimating the situation declines to be held on the defensive, snatches the initiative from Hooker and defeats him.

"Operating behind and about the enemy's base," is the title of the next chapter. The author shows the effect of this operation to consist in impoverishing the invaded country and depriving the enemy of its supplies. Sherman's campaign in 1864 which is quoted in support, lopped off one-half of the Confederate territory and destroyed the most prolific source of supply of the rebel armies. The army covering this source of supply sought to cover it by turning the enemy. But things had already come to such a pass that the movement no longer availed. History teaches that for the subjugation of a determined people the occupation of its territory is necessary, that this is, as a rule, impracticable until the enemy has been reduced by battle to such inferiority that he can no longer save himself without allies. The most effective movements of this character usually take place from a base at an angle to the enemy's base; they in fact constitute a flank attack on the enemy's base.

The author then discusses the effect of blockades in general, and the blockade of the Confederate States in especial, including the cruise of the *Alabama*.

In the 14th chapter we are introduced to tactical strategy. The author says: "The important advantages to be aimed at on the field of battle may be classified as follows:

"1. General preponderance.

"2. Local preponderance.

"3. Individual preponderance."

Under "Interior and Exterior Lines," p. 192, the figure does not agree with the text. If A were to advance straight in the direction of B it would reach the curved line of defense before B could. As regards that point, B has lost the advantage of interior lines by allowing A to approach as close as shown in figure.

In Fig. 36, p. 193, the conditions are reciprocal. The statement on "Use and Value of Road Junctions" might be plainer. This subject as well as strategic interposition as on p. 195 is really a matter of interior lines.

The selection of an object is the subject of the next chapter. In the last paragraph of the chapter the author states a method of action successfully pursued by Archduke Charles in 1796.

"Tactics as a Factor in Strategy" is the subject of the next chapter. We should have expected a statement to the effect that all strategic skill amounts to nothing if followed by tactical defeat. The author states at the beginning of the chapter "where an army cannot by manœuvring alone, place itself in a desired strategic relationship with a given point, it may seek to do so by force." This statement is characteristic of the author's strategy, it is very scientific, like Jomini, it constantly aims at overcoming the enemy by manœuvre, aims at geographical points and relies altogether too little on battle, forgetful of the fact that the best method of gaining geographical points is to defeat the enemy in the field. This idea of manœuvring is based on an overestimate of the power of the defensive. In fact the offensive is the stronger side as shown by Napoleon's wars and subsequent conflicts. The conditions illustrated on page 203 somewhat resemble those at and after the battle of Jena.

Chapter 17 treats of strategy as a factor in tactics. Here the author finally places "tactical" strategy in its proper place by subordinating to it "regular" and "political" strategy, and gives as illustrations the second Bull Run and Gettysburg cam-

paigns, and, in the next chapter, Jackson's valley campaign of 1862. Political strategy is then taken up under two heads :

1. The Government as the military objective.
2. The People as the military objective.

Under the first head the author distinguishes between embarrassing the hostile government and coercing it. Although distinguishing thus between two principal forms of political strategy, he does not make an equal distinction in the means applied. The fact is, the two forms differ merely in degree, and both ends are obtained by the same means. Every invasion entails "political" strategy in that "it carries war home to the enemy's people, etc." The pressure is brought to bear on the people and through it on the government. No means are indicated for coercing a government directly. What the effect of this political strategy will be on the government, depends on the popularity of the government, how it will affect the duration of the war, depends on the popularity of the war with the people. The people are therefore the more decisive object.

In illustration of this the author gives a sketch of the British operations in Georgia, the Carolinas and Virginia 1776–81. The acts of cruelty and inhumanity, murder, rapine, devastation, which constituted the political strategy in this instance, form certainly a good illustration. But political strategy of this character, save perhaps a slight approach to it in civil war, is not to be reckoned with in a future war, for no civilized nation can afford to load itself with the infamy attaching to such proceedings, and to this day Great Britain should blush for the acts of her servants in this war.

The last theoretical chapter in the book discusses war and strategy in general under the subheads of the political and military problem, the mobilization, the strategic formation, the design of operation and the plan of operation. It is the strongest chapter in the book. It points out what momentous questions confront a government at the outbreak of a war. Most of these questions can be answered in time of peace and should be, since the time at the outbreak of the war with its excitement and confusion is the least favorable. After reading this chapter there ought to remain no doubt in any reader's mind as to the appropriateness of "si vis pacem, para bellum."

The book terminates with excellent sketches of the Shiloh and Vicksburg campaigns. The Shiloh campaign proves the statement that a decisive blow opens the road to the heart of the enemy's country, although in this instance, "too much science" prevented the Federals from reaping the legitimate fruits of the victory.

Like all works on this subject, the book is hard reading ; the grouping of the subject matter is also somewhat novel. The theoretical part is held much on the lines of a Jomini, with Hamley interspersed here and there, and resembles the former in the excesssive use of scientific terms. The author no doubt believes with Jomini that clear definitions convey clear ideas. They have led him into great formality, further enhanced by numerous geometrical demonstrations. A special chapter on organization and its influence upon an army we regard as desirable, as also a fuller discussion of the offensive and defensive. The offensive throughout the book does not receive its proper share, and if General Lee achieved great things on the defensive, it must be remarked that history shows few leaders who though acting on the defensive during long periods, yet managed to keep their hands so free for taking the offensive at any time, as did this great general.

The chief attraction of the work lies in the historical illustrations, which, to our great regret, are limited to this side of the Atlantic ; for some striking exemplifications of strategic principles which are shown in the campaigns of Napoleon and Moltke, have not yet been illustrated in our own wars. These sketches are excellent and are interesting even if read apart from the text ; for they serve better to illustrate and to con-

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vey a clear outline of the course of events than anything that, to our knowledge, has appeared in print on the subject. The campaigns are stripped of detail, are presented in their main features and are to the point.

The volume is of handy size and printed in good, large type.

The author is to be congratulated upon the appearance of the second edition of his work, which ought to find a place in the library of every military student.

CARL REICHMANN,
1st Lieut. 9th Inf.

Interior Ballistics.*

Captain Ingalls in his new work on Interior Ballistics has made a fine addition to the literature on this subject.

He has culled from various authorities a great amount of data and has well arranged this into an excellent text-book.

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The main ultimate object of interior ballistics is to deduce formulæ for calculating for any gun and powder charge, the velocity of translation and of rotation of a projectile and the pressures of the powder gases upon the bore of the gun. As these formulæ are in a measure empirical the student should have impressed upon him that deductions cannot be drawn from the purely theoretical formulæ, and that too much faith should not be placed in any deductions drawn from data obtained by the pressure gauges now in use.

Captain Ingalls deserves the thanks of all computers for having placed in such convenient form, those most beautiful formulæ of Lieutenant Glennon of the U. S. Navy, and for using in his book, a clear and uniform system of notation.

The Army Officer's Examiner.†

For his latest work, "The Army Officer's Examiner," Colonel Powell deserves the hearty thanks of every army officer in any way connected with examinations for promotion in the line or in the Quartermaster's or Subsistence Departments. If the work is adopted as that from which examining boards shall select questions as far as practicable, the heretofore very unequal examinations of different boards may be hereafter made much more nearly equal, the labor of the recorder of such boards will be much reduced and candidates for promotion will find preparation for examination much simplified.

The contents of "The Army Officer's Examiner" may be briefly stated as follows: The Act relating to examinations for promotion in the line and the Quartermaster's and Subsistence Departments; rules of procedure for boards of examination; all orders and instructions regarding examinations and subjects on which officers of various grades and different branches of service are to be examined, questions and answers on following subjects in text-books authorized by War Department: Guard duty, military law, field engineering, signalling, drill regulations for cavalry, infantry and light artillery, hippology, fire discipline, troops in campaign, and special questions in ballistics, electricity, sea-coast defense, explosives and gunnery.

* *Interior Ballistics.* By Captain James M. Ingalls, 1st Artillery. Fort Monroe Press.

† *The Army Officer's Examiner.* By Lieut.-Col. Wm. H. Powell, 11th Infantry, U. S. Army. New York: John Wiley & Sons.

The subjects on which officers of the cavalry and infantry and of the Quartermaster's and Subsistence Departments are required to be examined appear to be well covered by the book; but the artillery officer will find that though the work contains much that is necessary for him, the "special questions" do not fully cover the different subjects enumerated thereunder, and that there are other subjects on which he may be examined not referred to in the book. As it is, however, the work will be found a valuable aid to every officer interested in examinations for promotion.

It is not to be supposed that such a book can or will take the place of all authorized text-books on which officers are required to be examined or that an officer by reading this work alone will fulfill all that is contemplated in the act relating to promotions. By diligent application between dates of promotion, an officer, at least if he be a second lieutenant of artillery, might commit to memory so much of "The Army Officer's Examiner" as interests himself and still not be a particularly shining light in his profession. When an officer is "cramming" for examination, however, he will find Colonel Powell's book particularly valuable as a *multum in parvo*, and if on going up for examination he is capable of answering any question therein, he may rest assured, he will not be found mentally incapacitated for service. A. M.

ERRATUM.

In the concluding lines of Colonel Clous' Historical Sketch of the Judge Advocate General's Department, on page 641 of the May JOURNAL, the quotation "this is a government of law, and all authority received must find its warrant thereunder," should read "this is a government of law, and all authority exercised must find its warrant thereunder."

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Prize Essay—1894.

I.—The following Resolution of Council is published for the information of all concerned:

Resolved, That a Prize of a Gold Medal of suitable value, together with a Certificate of Life Membership, be offered annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest; the subject to be selected by the Executive Council and the Prize awarded under the following conditions:

1. Competition to be open to all persons eligible to membership.

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1894. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate *the Essay deemed worthy of the prize;* and also in their order of merit those deserving of honorable mention.

In determining the essay worthy of the prize, the Board will be requested to consider its professional excellence, usefulness, and valuable originality, as of the first importance, and its literary merit as of the second importance. Should members of the Board determine that no essay is worthy of the prize, they may designate one or more essays simply as of honorable mention; in either case, they will be requested to designate one essay as first honorable mention. Should the Board deem proper, it may recommend neither prize nor honorable mention. Should it be so desired, the recommendation of individual members will be considered as confidential by the Council.

4. The successful Essay shall be published in the Journal of the Institution, and the Essays deemed worthy of honorable mention shall be read before the Institution, or published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the JOURNAL (exclusive of tables).

II.—The Subject selected by the Council at a meeting held Nov. 24, 1893, for the Prize Essay of 1894, is

"*DISCIPLINE:—Its Importance to an Armed Force and the best means of Promoting and Maintaining it in the United States Army*"

III.—The gentlemen chosen by the Council to constitute the Board of Award for the year 1894 are:

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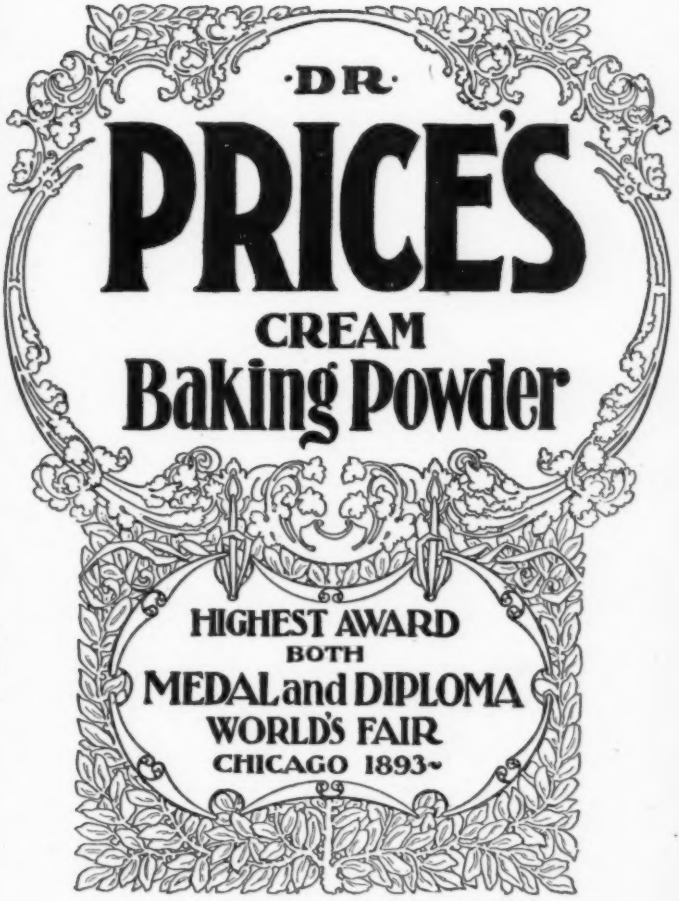
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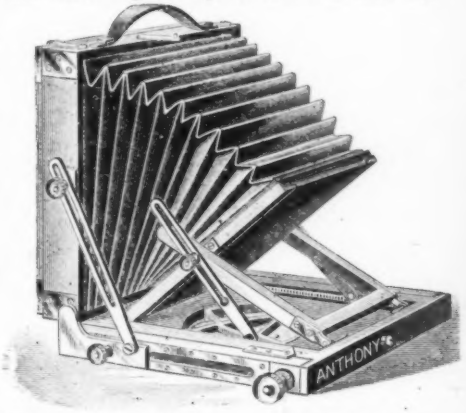

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THE QUARTERMASTER'S DEPARTMENT.

By Captain OSCAR F. LONG, A. Q. M., U. S. Army.

TO chronicle properly and systematically the history of the Quartermaster's Department would be to write a history of the army, of which it forms so important a part, with which it is so intimately associated, and without which it could not exist; for otherwise our army would be but a predatory mob, organized but not supplied; dependent upon chance for its existence, and for its supplies upon forays, like the forces of the feudal barons of mediæval times. The supply departments are the mainstay of an army.

In their relations the departments of the army are correlative. Upon the efficiency of the one the success of the other is largely dependent. The army, which is the faithful servant of the nation it represents, reflects also the condition of the people, socially and economically. It faithfully portrays the evolution from the earliest times to the present,—from barbarism to civilization, and keeps pace with the progress of the country. Its labors have been intimately associated with the spread of civilization, and no other agency has been so potent in perfecting the permanency of our republic,—and making its success assured and its power respected—as has been our army.

Whether in peace or war its duties have been onerous, but cheerfully borne. Whether dealing with savage foe or foreign invader, success has crowned its efforts.

During times of peace the army is dependent for its very existence upon the moods of Congress, and the whims of caprice,—moods as variable as those of the ocean, and whims like those of the breeze. During times of war, the country and Congress depends upon the army for active aid, whether to suppress insurrection, repel invasion, or to fight for actual existence as a free and independent people,—a freedom and independence vouchsafed by our Constitution, a legacy left us by our forefathers, still faithfully guarded.

The evolution which has brought our army to its present state of usefulness, has been dependent upon circumstances and conditions in the history of the country, at its different epochs, and the necessities then existing. As with the army, so with the departments which constitute its staff, and with the several branches of the line,—the cavalry, artillery and infantry; for from time to time each has been changed in numbers and in organization as circumstances and conditions have changed, and in order that they might the better meet conditions or necessities then existing. The change has not been radical; it has been more in the nature of enlargement and improvement, as necessity demanded.

This development has brought the army through various and varied

vicissitudes to its present state of perfection, and has been necessary to meet the requirements of a modern civilization in a country whose geographical isolation is its protection, and whose military and naval strength, its safeguard.

Though essentially a nation of soldiers, in time of peace we do not prepare for war. On the contrary, from our very isolation we rest in a state of fancied security.

Whether in peace or war, the army is mainly dependent upon its supply department, the duties of which are important and multifarious, the obligations great, and the responsibilities enormous.

Facts are interesting and figures tedious, but to show the importance of the operations of a great department of supply, they are a necessity, particularly in referring to the work of the Quartermaster's Department during the War of the Rebellion, when the enormous expenditure, perfect accountability, and recognized efficiency, are of record as unequalled in military history, ancient or modern.

The following is but a brief brochure, containing the more important facts connected with the organization of the Quartermaster's Department from the War of Independence to the present time, compiled from the most authentic available data.

FROM 1775 TO 1812.

The earliest legislation relating to the Quartermaster's Department is found in the Journals of Congress. The Continental Congress in session at Carpenter's Hall, Philadelphia, adopted the following resolution June 16, 1775:

"*Resolved*, That there be one Quartermaster General for the grand army, and one deputy under him for the separate army. * * * That the pay of the Quartermaster General be $80 per month, and that of the deputy $40 per month."

The same Congress, on the 19th of July, 1775, adopted the following resolution:

"*Resolved*, That the appointment of a Quartermaster General * * * be left to General Washington."

Acting under this authority General Washington appointed Major Thomas Mifflin, of Pennsylvania, Quartermaster General; and writing to the President of Congress on the 21st of September, informed him of the fact, hoping and believing that such appointment would be universally acceptable.

Major Mifflin, immediately after his appointment, entered upon his duties in the Quartermaster's Department.

Prior to December 22, 1775, no provision had been made for the rank of the one who filled the position of Quartermaster General of the Army of the United Colonies, but on that date the following resolution was passed by Congress:

"*Resolved*, That the Quartermaster General have the rank of a colonel in the Army of the United Colonies."

On the 16th of May following, Colonel Mifflin was elected by Congress a brigadier general of the army, whereupon he resigned his office of Quarter-

master General, and on the 5th of June, 1776, Stephen Moylan was elected to fill the vacancy.

The position and duties of Quartermaster General appear to have been distasteful to Colonel Moylan, and having tendered his resignation to Congress, that body, on the 1st of October, 1776, resolved that "Brigadier General Mifflin be authorized and requested to resume the said office, and that his rank and pay as brigadier general be still continued to him." In accordance with this resolution, General Mifflin, on October 1, 1776, again took charge of the affairs of the Quartermaster's Department.

On the 27th of December, 1776, the Congress empowered General Washington to appoint a clothier general for supplying the army. The duties of this office, however, did not at that time pertain to the Quartermaster's Department.

On February 19, 1777, General Mifflin was elected a major general by the Continental Congress. On the 8th of October, 1777, he requested leave to resign his commission of major general and office of Quartermaster General on account of ill health; and November 7, 1777, the Congress resolved that his resignation of the office of Quartermaster General be accepted, but that his rank and commission of major general be continued to him, without the pay annexed to that office, until the further order of the Congress. With a view, however, to temporarily retain his services in the Quartermaster's Department, the Congress resolved, on the 8th of November, 1777, that he "be desired,—notwithstanding his resignation of Quartermaster General was accepted,—to continue in the exercise of that office, and that he be invested with full powers to act until another Quartermaster General should be appointed and should enter upon the duties of the office." It does not appear, however, that he again entered formally upon these duties.

The condition of the Quartermaster's Department at this time, without an ostensible head, and with an organization to a certain extent defective and incomplete, was regarded with much solicitude by General Washington.

In this emergency Major General Nathaniel Greene, an able, gallant officer and personal friend of General Washington, was selected by him to fill the vacancy, and was elected by Congress on March 2, 1778. That body gave him authority to employ two assistant quartermasters general, who should be acceptable to him, and power to appoint all other officers of his department, and specially provided that General Greene should retain his rank of major general in the army, which he then held.

General Greene unwillingly accepted the office. He disliked any appointment which required the keeping and expenditure of public funds, and was unwilling to forego the opportunities which might arise for active service in the regular line of the army. It was only at the earnest entreaty of Washington that he finally consented, stipulating meanwhile that he should not lose his right of command in action.

Entering, however, upon his new duties he executed them with great zeal and ability, encountering obstacles of no ordinary kind, and rendering services of the utmost importance to the army. He considered, however, that Congress had not promptly seconded his views in relation to the business of the department, and he was disinclined to remain at its head. On

the 22d of April, 1779, he wrote to General Washington that he would be happy to obtain the command in the South, if General Lincoln's physical condition rendered him incapable of continuing in command.

General Washington replied April 24, 1779, as follows:

"I am sorry for the difficulties you have to encounter in the department of Quartermaster, especially as I was in some degree instrumental in bringing you into it. If your judgment points to a resignation of your present office, and inclination leads to the Southward, my wishes shall accompany it."

It does not appear, however, that this point was pressed by General Greene at the time. He rendered active services in the field in 1779 while Quartermaster General. The question having been raised as to his proper command under such circumstances, he wrote to General Washington on the subject, and received a reply dated September 3, 1779, stating that when General Greene accepted office as Quartermaster General and made a reservation of his rank, General Washington did not consider that he was to retain thereby an actual permanent command. He further wrote:

"The military reason which prevents a Quartermaster General from exercising command in ordinary cases I take to be this, that whatever may be the fact, the presumption is that both in action and out of action he has, generally speaking, sufficient employment in the duties of his office, and circumstances alone can decide when these are compatible with actual command."

Congress, on November 25, 1779, Resolved, "That the department of the Quartermaster General to be for the future under the superintendence and direction of the Board of War."

At this time the attention of Congress had been attracted to the organization of the staff departments as they then existed, and on January 21, 22, and 23, 1780, three commissioners,—Mr. Schuyler, a member of the Continental Congress; General Mifflin, and Colonel Pickering,—were chosen to make inquiry into the expenses of these departments.

In view of this inquiry a draft of a plan of reorganization of the Quartermaster's Department, considered practicable both by General Washington and General Greene, was submitted by the latter to this committee.

Great hostility to both of these officers, however, was manifested by certain members of the Congress, especially on the part of those, who it is believed, had organized the movement to place General Gates at the head of the army; and the plan finally submitted to that body and adopted by it on the 15th July, 1780, following, was found to differ widely from that which had been proposed by them.

The new law provided for one Quartermaster General and one Assistant Quartermaster General, to be appointed by the Congress; one Deputy Quartermaster for the main army, and one for each separate army, to be appointed by the Quartermaster General, who was also to appoint, if he deemed it necessary, a deputy for each state, to be approved by the Supreme Executive of the State, said deputies to appoint, in turn, as many assistants as required, and also all store-keepers, contractors, clerks, conductors, artificers, and laborers, found necessary to the service to be appointed by the deputies in their respective districts. The act occupies several pages,

and enters into the most minute details for the government of the department.

General Greene was greatly dissatisfied with the new law. He considered the number of assistants too small, their salaries too low, and the whole scheme inefficient. Early in August, 1780, he tendered his unconditional resignation as Quartermaster General, requesting Congress to appoint his successor at once without loss of time, and expressing his desire to remain no longer in the department than was necessary to close his accounts and to set fairly in operation the new system as adopted for the future government of the department. August 5, 1780, Congress Resolved, "That the absolute refusal of Major General Greene to act under the new arrangement of the Quartermaster General's Department, has made it necessary that the office of Quartermaster General be immediately filled"; and on the same day Colonel Timothy Pickering was elected by Congress to fill the vacancy.

Thereupon Congress adopted this resolution:

Resolved, That Timothy Pickering, Esq., having been appointed Quartermaster General, upon an extraordinary emergency, be continued as a member of the board of war; but that the exercise of all his powers at the said board, and his pay as a member thereof, be suspended during such time as he shall continue Quartermaster General.

That while he holds the office of Quartermaster General he have the rank of colonel and the pay and rations of a brigadier general over and above the pay allowed the Quartermaster General in the late arrangement of the Quartermaster's Department.

Upon assuming the duties of his office Colonel Pickering found many serious difficulties with which to contend. The scarcity of funds, the depreciation of the currency, and the want of system and harmony in the Quartermaster's Department under the new organization, seriously interfered with the prompt transaction of business.

On March 14, 1782, Congress by resolution authorized the appointment of one additional deputy quartermaster for the Southern Army, and on the same day reduced the pay of the Quartermaster General to that of Major General.

On October 23, 1782, Congress Resolved,

"That the establishment of the Quartermaster's Department by resolution of Congress of July 15, 1780, be after January 1, 1783, repealed, and the following regulations then adopted in its stead.

"Resolved, That there be one Quartermaster General, the present Quartermaster General to be continued in office; and hereafter as vacancies arise to be appointed by Congress.

"That the Quartermaster General, with the approbation of the Commander-in-Chief, appoint the following officers for the armies of the United States, viz:

"For the Main Army: One Deputy Quartermaster, one Wagon Master, one Commissary of Forage, one Director and one Sub-Director, of a Company of Artificers.

"For the Southern Army: One Deputy Quartermaster, one Deputy Commissary of Forage, one Deputy Wagon Master, one Director and one Sub-Director of a Company of Artificers, and as many Assistants in the Main and Southern Army to perform the duties of Quartermasters of Brigades, Storekeepers, Clerks and such other duties in the Quartermaster's Department as the service may require, and also as many Wagon Conductors."

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The business of the department was growing less with a constantly decreasing army, and with a view to economy and reduction of expenses, Congress on the 25th July, 1785, resolved that the department of Quartermaster General be considered as ceasing from that date, and that the Secretary of War and all others concerned be governed accordingly.

By a resolution of Congress, dated September 29, 1785, a commissioner, previously appointed for the settlement of the accounts of the Quartermaster General's department, was authorized and directed to enter upon a general settlement of the various accounts of Col. Pickering, as Quartermaster General, and of the several deputies serving in the department.

On May 8, 1786, Mr. Jonathan Burrill was elected by Congress as Commissioner to settle the accounts of the Quartermaster's department at a compensation of $1250 per annum.

On October 2, 1788, Congress adopted the report of a Committee appointed to make full inquiry into the proceedings of the Department of War. This Committee remarks on the affairs of the Quartermaster's Department as follows:

"The Quartermaster's Department on the frontiers is arranged on principles highly economical and beneficial to the public. Instead of an officer at the head of this department, with his train of attendants, all supplies are furnished by the contractors of provision, who have also, from time to time, contracted with the Secretary of War, to furnish all necessary articles on the frontiers, which shall be required for the troops, on the following principles.

"1st. No article to be furnished but by an order in writing from the commanding officer of the troops, or the commanding officer of a separate post, who shall be responsible to the Secretary of War, that only such articles shall be ordered as the situation of the troops render indispensably necessary.

"2d. That for all articles so furnished the original bills of parcels shall be produced by the contractor, which shall be verified upon oath if required.

"3d. That no charge shall be allowed the contractors which shall be deficient in the vouchers, the nature of which are precisely pointed out.

"4th. That for all supplies, advances and services rendered in this line, the contractors shall have an allowance made of five per cent. on the settlement of their account, every six months at the Treasury. All necessary articles which are furnished within the state for the troops, are purchased by the Secretary of War, without any commission or charge theron to the public."

This arrangement existed previously to the resolve of Congress for abolishing the Quartermaster General's Department, July 25, 1785. The Quartermaster's Department at this time existed more in name than reality. It had no organization or effective force.

On March 4, 1789, the first Congress of the United States convened in Federal Hall, New York City. The army at this time consisted of about 2000 men, and no legislation affecting an increase of this force appears to have been thought necessary by Congress until 1791, when the Indian hostilities on the western frontier attracted the special attention of that body. After a careful examination of the subject, it was decided to establish a line of posts sufficient to maintain communication from the Ohio to the Maumee, the intention being to build a strong fort on that river, and to

leave in it a garrison of a thousand men, large enough to send out detachments to keep the neighboring Indians in awe.

On the 3d of March an act was passed which authorized raising and adding another regiment to the force at that time in the service, etc. From sections 5 and 6 of this act is taken the following.

"In case the President of the United States should deem the employment of a major general, brigadier general, a quartermaster, and chaplain, or either of them, essential to the public interest, that he be, and he hereby is, empowered, by and with the advice and consent of the Senate, to appoint the same accordingly. * * * The quartermaster shall be entitled to the same pay, rations, and forage as the lieutenant colonel commandant of a regiment."

On the 4th of March, the day following, Major General St. Clair was made commander-in-chief of forces destined for Forts Pitt and Washington and neighboring posts as places of rendezvous, whence to carry out the plan of campaign above referred to; and on the same day Samuel Hodgden, of Pennsylvania, having been appointed a quartermaster under the act, by President Washington, was confirmed as such by the Senate.

On March 5, 1792, an act was passed making further provision for the protection of the frontier. Under section 7 of this act, fixing the monthly pay, rations and forage to be allowed to officers of the army, the grade of deputy quartermaster was recognized, although it does not appear to have been created by legislation of Congress. This section also provided for the detail of line officers as quartermasters of the regiments being formed, with additional compensation for the extra duty thus performed by them.

On March 28th General St. Clair left Philadelphia for Fort Washington, via Fort Pitt, arriving there May 15th following. Quartermaster Hodgden, however, tardily followed his commanding officer and failed to reach Fort Washington until September 10th, although an express had been received by him some time previously from General St. Clair to hasten forward. The little army, numbering about 2000 men, suffered in the meantime and subsequently for the want of the most necessary supplies.

The quartermaster's and other stores forwarded from the east to the troops were found to be deficient in quantity and bad in quality. Boats for the transportation of the troops were not in readiness; horses which were to be furnished by the contractors were not brought forward; the rations of the men were failing, and the green forage for the animals had been touched by the early frost. In short, the extreme deficiencies and derangements of the business of the quartermaster and contractor of provisions were considered to have been, to a great extent, the cause of the subsequent failure of the expedition.

On April 19, 1792, Quartermaster Hodgden was superseded by James O'Hara, of Pennsylvania, the latter being nominated by President Washington and confirmed by the Senate as Quartermaster General, although the law at this time only provided for a "quartermaster."

In May following, the duties of the Quartermaster's Department were somewhat reduced by the transfer of the power of purchasing and contracting for army supplies to the Treasury Department, as will appear from Section 5 of act approved May 8, 1792, as follows:

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"That all the purchases and contracts for supplying the army with provisions, clothing, supplies in the Quartermaster's Department, military stores, Indian goods, and all other supplies or other articles for the use of the Department of War, be made by or under the direction of the Treasury Department."

In accordance with the request of the Secretary of the Treasury, in a letter to Congress dated December 2, 1794, it was further enacted, February 23, 1795, that an officer be appointed in the Treasury Department, to be known as the Purveyor of Public Supplies, "whose duty shall be, under the direction of the Secretary of the Treasury, to conduct the procuring and providing of all arms, military and naval stores, provisions, clothing and generally all supplies requisite for the service of the United States." The compensation was $2000 per annum.

The grade of Quartermaster General, which had been abolished July 25, 1785, appears to have been again recognized in an act of March 3, 1795, for continuing and regulating the military establishment. This act also recognizes a Deputy Quartermaster General and regimental quartermasters. The grade of Quartermaster General, however, does not appear to have been specifically recreated by legislation of Congress until the act of May 30, 1796. At that time an act was passed authorizing, among other general staff officers, a Quartermaster General. The same act provided that the general staff should continue in service until March 4, 1797, and no longer. On June 1, 1796, Lieutenant Colonel O'Hara having resigned, John Wilkins, Jr., of Pennsylvania, was appointed by President Washington and confirmed by the Senate as Quartermaster General under this act.

On March 3, 1797, the act of May 30, 1796, was amended to continue the grade of Quartermaster General, that officer to receive the pay and emoluments previously authorized by law.

During the following year, by reason of the unfriendly demonstrations of France, it was considered necessary to temporarily increase the force of the army to meet any exigency which might arise. Accordingly Congress, by an act of May 28, 1798, authorized the President "in the event of declaration of war against the United States, or of actual invasion of their territory by a foreign power, or of imminent danger of such invasion discovered, to call into active service a provisional army of not exceeding 10,000 men."

Section 7 of this act provided that in case the President should judge the employment of a Quartermaster General essential to the public interest, he was authorized to appoint the same accordingly, subject to the confirmation of the Senate. The Quartermaster General was to be entitled to the rank, pay and emoluments of a lieutenant colonel.

General Washington had retired to private life and was then residing at Mount Vernon. Just before the close of the session of Congress he was nominated and confirmed Lieutenant General and Commander-in-chief of all the troops to be raised. This command Washington accepted with the express condition that he should not be called into active service until the army was in a situation to require his presence, unless urgency of circumstances should sooner make it necessary.

On December 31, 1798, President John Adams transmitted to Congress

a special report from the Secretary of War, dated December 24, relative to the reorganization of the army.

Congress, taking the entire subject of army reorganization into consideration, passed the act of March 3, 1799. Sections 10 and 12 of this act read as follows:

SECTION 10. That there shall be a Quartermaster General of the army of the United States, who shall be entitled to the rank, pay, emoluments, and privileges of a major general.

SECTION 12. That to any army of the United States, other than that in which the Quartermaster General shall serve, there shall be a Deputy Quartermaster General, who shall be a field officer, and who, in addition to his other emoluments, shall be entitled to $50 per month, which shall be in full compensation for his extra services and travelling expenses; but the provisions of this act are not to affect the present Quartermaster General of the army of the United States, who, in case a Quartermaster General shall be appointed by virtue of this act, is to act as Deputy Quartermaster General, and shall hereafter have the rank of lieutenant colonel; and that to every division of an army there shall be a division quartermaster, who in addition to his other emoluments, shall be entitled to $30 per month, which shall be in full compensation for his extra services and travelling expenses; and that to every brigade there shall be a brigade quartermaster, who, in addition to his other emoluments, shall be entitled to $24 per month, which shall be in full compensation for his extra services and travelling expenses; each of which officers shall be chosen by the Quartermaster General from among the regimental officers.

It was also provided by this act that no regimental officer of higher rank than a captain be appointed a division quartermaster, and that no one of higher rank than first lieutenant be appointed quartermaster of a brigade.

The difficulties with France which were at this time apprehended were not to any serious extent realized, hostilities being mainly carried on by the navy, and under the acts of Congress of February 20 and May 14, 1800, enlistments and military appointments under the act of March 2, 1799, were suspended.

The appointment of a new Quartermaster General, under the act of March 3, 1799, was not made, and Mr. Wilkins remained in charge of the duties of the station, his position being raised to that of major general, as would appear from a message of President Jefferson to Congress in 1802.

By the act of March 16, 1802, fixing the military peace establishment, it was enacted that the army be reduced to one regiment of artillerists and two of infantry, with the necessary officers. Sections 3, 16 and 17 of this act provide for the appointment of paymasters, assistant paymasters, and military agents, upon whom the duties of the Quartermaster's Department were thenceforth to devolve. They authorized the appointment of one paymaster of the army, seven paymasters, and two assistants, who, in addition to their other duties, were to have charge of the clothing of troops; also the appointment of three military agents, and such number of assistant military agents as might be thought expedient by the President, not exceeding one at each military post, it being the duty of these agents and assistants to purchase, receive, and forward to their destination all military stores and other articles for the troops in their respective departments, and all goods and annuities for the Indians; they were to make returns of all property which would come into

their possession to the Department of War. Both paymasters and agents were required to file bonds for the faithful performance of their duties. Under operation of this act John Wilkins, Jr., ceased to be Quartermaster General, and Peter Gansevoort, of New York, for the northern department; William Linnard, of Pennsylvania, for the middle department; and Abraham D. Abrahams, of Georgia, for the southern department, were appointed by President Jefferson as military agents, and confirmed as such by the Senate, April 29, 1802.

The next legislation relating to the Quartermaster's Department is found in the act of April 12, 1808, which granted authority to raise, for a limited time, an additional military force in view of apprehended difficulties with foreign powers. This act provided for two brigade quartermasters and a quartermaster to each of the eight regiments to be raised under it.

THE WAR OF 1812–1814.

At this time war with Great Britain seemed imminent, as serious complications had arisen. It was hoped by diplomacy to avoid the impending calamity, but, as a prudential measure, it had been decided to further increase the military force, and by the act of January 11, 1812, thirteen new regiments were authorized to be added thereto. On March 28th, following, an act was approved reëstablishing the Quartermaster's Department and reviving the grade of Quartermaster General.

Provision was made for a Quartermaster General and four deputy quartermasters, to be confirmed by the Senate, and as many assistant deputy quartermasters as the service might require, to be appointed by the President alone. The Quartermaster General to have the rank and pay of a brigadier general, and the deputy quartermasters $60.00 per month, five rations and forage for two horses. The assistant deputy quartermasters $40.00 per month, three rations, and forage for one horse.

These officers were to purchase military stores, camp equipage and other articles requisite for troops and provide means of transportation.

The act also provided for a Commissary General of Purchases with a salary of $3000 per annum, and necessary assistants with compensation derived from commissions on money disbursed, not exceeding, however, $2000 per annum. The Commissary General of Purchases was required to purchase all arms, military stores, clothing—formerly purchased by paymasters—and all articles of supply. The Deputy Commissaries were, in cases of necessity, to act under the orders of the Quartermaster General in purchasing supplies.

The office of purveyor of public supplies, and the offices of the military agents were abolished.

Under this act President Madison nominated William Jones, of Pennsylvania, to be Commissary General of Purchases, and Morgan Lewis, of New York, to be Quartermaster General, and they were confirmed by the Senate on April 3 and 4, 1812, respectively.

On the 23d of April, 1812, an act was approved organizing a corps of artificers, to be attached to the Quartermaster General's Department. This corps was to consist of one superintendent, appointed by the President,

four assistants, two master masons, two master carpenters, two master blacksmiths, two master boat-builders, two master armorers, two master saddle and harness makers, twenty house carpenters, five ship carpenters, twenty blacksmiths, sixteen boat-builders, sixteen armorers, twelve saddle and harness makers, and twenty-four laborers, to be selected from the privates of the army, or engaged from among citizens by the superintendent. The corps of artificers was to be engaged for three years, unless sooner discharged by the President.

On May 14th following an act was approved, establishing an ordnance department and creating the grade of Commissary General of Ordnance, which act at once relieved the Commissary General of Purchases of some of the most important duties then devolving upon him.

On the 18th of June, 1812, war against Great Britain was declared and on June 26, 1812, an act was approved for the more perfect organization of the army of the United States and providing for the increase of the same.

By an act of July 6, of the same year, the President was authorized to increase the number of officers of the Quartermaster's Department by the appointment of one Deputy Quartermaster General to any army of the United States other than that in which the Quartermaster General was serving, and such number of assistant deputies, not exceeding thirty, as the public service may require. The military force was further increased by act of January 29, 1813. On March 3d following an act was approved providing for the supplies required for the army and for the accountability of persons intrusted with the same.

On June 2, 1813, Richard Cutts, of Massachusetts, was nominated by President Madison and confirmed by the Senate as Superintendent General of Military Supplies, under the provisions of the above act.

March 3, 1813, an act was also passed "for the better organization of the general staff of the army," making radical changes in the Quartermaster's Department. It provided for eight Quartermasters General, eight Deputy Quartermasters General, and thirty-two assistant deputy Quartermasters General; the Quartermaster General attached to the principal army to have the brevet rank and the pay and emoluments of a brigadier general as before; all other Quartermasters General to have the brevet rank and the pay and emoluments of colonels of infantry, and the deputies and assistant deputies to have the brevet rank and the pay and emoluments of majors of cavalry and captains of infantry, respectively; the President to take these officers from the line or not, as he might consider expedient.

Section 5 made it the duty of the Secretary of War to prepare a code of regulations for the better government of the staff departments, to be used for the army upon receiving the approval of the President.

Under the provisions of this act Robert Swartwout, of New York, was appointed by President Madison as Quartermaster General on March 21, 1813, and designated as chief of the Quartermaster's Department in place of General Lewis, who had on March 2d of that year received the appointment of major general in the army.

On the 10th February, 1814, it was enacted that three regiments of rifle-

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men be raised, one quartermaster and one quartermaster sergeant being allowed to each.

On March 30, 1814, it was enacted that three regiments of artillery be formed into one corps, and organized into twelve battalions, one quartermaster being authorized to each battalion. That in lieu of two regiments of light dragoons in service, there be organized one regiment * * * with one quartermaster * * * and one quartermaster sergeant. Section 20 of this act prohibited taking quartermasters of any grade from the line of the army.

FROM 1815 TO 1846.

On the 11th of February, 1815, news of the proclamation of peace was brought to New York, causing the greatest joy and enthusiasm throughout the country. February 17th the Senate of the United States ratified the treaty of peace between the United States and Great Britain, which had been concluded at Ghent on December 24, 1814.

On the 3d of March following an act was passed by Congress reducing the army, and fixing the military peace establishment at 10,000 men, which provided for one quartermaster and quartermaster sergeant to each regiment of artillery and riflemen; also four brigade quartermasters, to be taken from the subalterns of the line. This act made it the duty of the President to discharge all officers who, by its operation, became supernumerary. Accordingly, on May 17, 1815, orders were issued from the Adjutant and Inspector General's office announcing that the President had so arranged the general staff as to include one Quartermaster General and two Deputy Quartermaster Generals, provisionally retained, and the four brigade quartermasters provided for by the law; all other officers of the Quartermaster's Department, whose accounts were unsettled, were to be allowed to remain in service during a reasonable period, for the single purpose of rendering and settling them.

Robert Swartwout was continued Quartermaster General, with the brevet rank of brigadier general.

At this time the United States was divided into two military divisions, viz.: Division of the North and Division of the South, the two Deputy Quartermasters General, provisionally retained, being assigned to these respective divisions.

On December 27, 1815, William H. Crawford, Secretary of War, in a report to the House of Representatives, referred to the staff officers who had been provisionally retained in the military service, and recommended that in organizing the general staff provision be made, among other officers, for one Quartermaster General, who should be stationed at Washington. This recommendation does not appear to have received favorable consideration at that time, but on the 24th of April, 1816, an act was passed reorganizing the staff departments.

The first section of this act authorized the appointment of one Quartermaster General, with one Deputy Quartermaster General to each division, and an assistant of each to every brigade; these latter, by the law, superseded the brigade quartermasters and inspectors then existing.

Section 5 provided that the purchasing department consist of one Com-

missary General of Purchases, as before authorized, one deputy commissary to each division, six assistant commissaries of issues, and as many *military storekeepers*, to be subject to the rules and articles of war in the same manner as officers of the army, as the service might require. The salaries of the latter were to be regulated by the Secretary of War according to the duty they were performing, not, however, to exceed the pay and emoluments of a captain of infantry. The salaries of the former were fixed by law.

Section 7 made it the duty of the President of the United States to prescribe the quantity and kind of clothing to be issued annually to the troops.

Section 9 authorized all officers of the general staff to retain the pay and emoluments secured to them by the act of 3d March, 1813.

General orders issued from the Adjutant and Inspector General's office, May 3, 1816, announced that, in conformity with the above act, James R. Mullany, of New York, and George Gibson, of Pennsylvania, had been appointed Quartermasters General of the divisions of the north and south, respectively, with the rank of colonel, to date from April 29, 1816.

On the 14th April, 1818, an act was passed further regulating the staff of the army, in accordance with a plan suggested by Mr. Calhoun, Secretary of War.

Section 3 of this act repealed so much of the act of April 24, 1816, as allowed one Quartermaster General to each division, and provided that the Quartermaster's Department consist, in addition to the two Deputy Quartermasters General and the four assistant deputy Quartermasters General, then authorized, of *one Quartermaster General*, with the rank, pay, and emoluments of a brigadier general, and as many assistant deputy Quartermasters General as the President might deem proper, not exceeding, in the whole number, 12. This act also repealed former acts relating to forage, wagon and barrack-masters.

President James Monroe, under this act, as will be seen by reference to general orders from the Adjutant and Inspector General's office, of April 30, 1818, appointed William Cumming, of Georgia, Quartermaster General, to date from April 18, 1818, in lieu of Quartermasters General of divisions.

General Cumming declined the appointment conferred upon him, and on the 8th May, 1818, Brevet Colonel Thomas S. Jesup, Lieutenant Colonel 3d United States infantry, was appointed Quartermaster General by President Monroe to fill the vacancy.

Immediately upon the receipt of the notice of this appointment, Colonel Jesup, then at Brownsville, Texas, started for Washington city, and upon the 15th of June, 1818, entered upon the duties of his new position.

On the 17th July following he submitted to the Secretary of War a comprehensive *projet* of the nature and functions of the Quartermaster's Department and the duties of its officers. This *projet*, having met with the approval of the Secretary of War, was embodied by Major General Winfield Scott in the code of regulations compiled under the act of March 3, 1813, and published for the information and guidance of the army, in July, 1821. The following is a verbatim copy:

QUARTERMASTER GENERAL'S OFFICE,
17th July, 1818.

The principal objects of the Quartermaster's Department are: To insure an ample and efficient system of supply. To give the utmost facility and effect to the movements and operations of the Army. And to enforce a strict accountability on the part of all officers and agents charged with monies or supplies.

To accomplish these objects, the following regulations are proposed:

The Quartermaster General, as chief of the department, will be stationed at Washington, and be allowed one assistant, one clerk, and as many subaltern officers as the duties of his office may require. He will be liable, however, to be ordered to any point where his presence may be necessary, or his services required.

He will have the direction of the correspondence of his department, and it shall be his duty to make himself acquainted with the frontiers, both maritime and interior, and with the avenues leading to the contiguous Indian and foreign territories, with the resources of the country, and particularly of the districts on the frontier, with the most eligible points for concentrating troops and supplies, whether in relation to offensive or defensive operations, with the military force of different sections of the country. The relative expense of concentrating at particular points, and the relative military advantages of those points. And with the prices of all articles of supply and of transportation. It shall also be his duty to cause barracks and storehouses to be constructed, to designate the sites for depots, the routes for transportation and communication between different posts and armies, and the course of military roads.

It shall be the duty of the Quartermaster General to prescribe a uniform system of returns, reports, statements and estimates for his department, and he shall, under the direction of the Secretary of War, have the entire control of the deputies and assistants, and generally of all officers and agents acting in or making disbursements on account of the department, in all that relates to the administrative part of their duties, and to their accountability—the generals or commanding officers having the military control.

The deputies or assistants whom the Quartermaster General may assign to the posts of Philadelphia, New York, Pittsburg, Detroit, Saint Louis, and New Orleans, shall not be removed from their stations except by authority of the War Department.

Officers of the Quartermaster General's Department shall not be subject to detail, nor be employed upon any other duties than those of their department, except by order of the Secretary of War, or of a general commanding a division.

No officer of the Quartermaster-General's Department will be permitted to engage, either directly or indirectly, in trade or traffic of any description.

All monies for the Quartermaster's Department will be drawn by the Quartermaster General, and distributed by him to disbursing officers, as the service may require; the receipts of those officers will be his vouchers, and on producing them, or evidence of the transmission of the money, he shall receive a credit, and the person receiving the money shall be charged.

Accounts of subordinate officers of the Quartermaster's Department, whether of money or of property, will be forwarded quarterly to the Quartermaster General. They will be examined and transmitted, with the remarks of the Quartermaster General, to the proper accounting officer. Should vouchers be suspended or disallowed, the accounting officer will return them to the Quartermaster General with his reasons in writing for such suspension or disallowance; and it shall be the duty of the Quartermaster General to require from the officer proper vouchers, or the necessary explanations.

Whenever practicable, the senior quartermaster of each separate army may be re-

quired to receive and account for all monies received on account of the Quartermaster's Department for that army. Military departments represent separate armies; the senior quartermaster, therefore, may, if required, receive and account for all monies for the service of his department.

Officers of the Quartermaster's Department will forward their accounts for settlement at the times prescribed; on failure of which they will be recalled, and their places supplied by others.

All officers charged with monies or stores of the Quartermaster's Department will make, from time to time, such returns, reports, statements, and estimates as the Quartermaster General may require.

No expenditure will be made at permanent posts in time of peace for the erection or repair of barracks and quarters, where the whole sum required to complete the work shall exceed five hundred dollars, unless ordered by the Secretary of War.

Whenever any extraordinary expenditure shall be required, particularly if it do not properly belong to the Quartermaster's Department, it shall be the duty of the officer requiring the same to furnish the quartermaster with duplicate certificates of the necessity of such expenditure. If it be made necessary by the failure of any other department, the fact must be stated.

The Quartermaster General may, whenever he shall deem it necessary, cause a thorough inspection to be made of the books and accounts of quartermasters. This inspection shall embrace property as well as money, and shall extend to contracts, to the prices paid for articles purchased, the prices paid for transportation, and generally to every article of supply, and to all objects connected with the department. The books and accounts of the Quartermaster General shall be subject to a similar inspection.

Inspecting officers will notice in their reports all orders of commanding officers requiring the expenditure of money contrary to regulations. They will state particularly whether supplies be forwarded promptly, and whether proper regard be paid to economy.

(Signed) TH. S. JESUP,
Quartermaster General.

Approved:

(Signed) J. C. CALHOUN.

The following letter is interesting as showing the scope of the Quartermaster's Department in those early days:

WASHINGTON, Dec. 14, 1819.

Sir:—In reply to the questions propounded to me this morning, I have the honor to observe, that if it be the intention of the Government, in operating against Florida, to employ the troops of the South Division only, those on the Atlantic may be concentrated at Amelia Island in fifteen or twenty days, completely equipt for the field. Those in the vicinity of New Orleans or Mobile, may effect a junction in about three weeks, either at Mobile, or at some point within the Territory of Florida, in the vicinity of Pensacola. Should the force of the South Division be considered insufficient for the objects contemplated, the light artillery at Boston might be transported to Amelia Island in twenty days, and to Pensacola in a month; and the Second Regiment at Sackett's Harbor might be removed, by the way of the city of New York, to Amelia in five weeks, and to Pensacola in forty-six days. If the movement of those troops be determined on, a convoy will be necessary in order to protect them from capture.

The Spaniards have probably fifteen hundred men divided between Pensacola, Saint Marks, and Saint Augustine, and they may be reinforced by an equal, if not a greater number, from Cuba; for if our operations be confined to Florida, every soldier

may be drawn from Cuba for its defense. And the disposable force of Cuba, united with the Seminole Indians, may be thrown upon any point of our line of operations which Spain may select.

A reinforcement from Cuba may be prevented by a naval force arriving in the Gulf of Mexico.

Accompanying this is a statement in relation to the movement of the light artillery and the 2d Regiment.

(Signed) TH. S. JESUP,
Quartermaster General.

The HON. JOHN C. CALHOUN,
Secretary of War.

On March 2, 1821, an act of Congress was approved reducing the army and fixing the milltary peace establishment. Under this act the army was to be composed of four regiments of artillery and seven of infantry, with certain officers of engineers, ordnance, and the staff.

Section 7 of this act provided for one Quartermaster General (who under the act of March 28, 1812, received the pay and emoluments of brigadier general), two quartermasters with rank, pay, etc., of majors of cavalry, and ten assistant quartermasters, to be taken from the line and to receive additional compensation, varying from $10 to $20 per month, as the Secretary of War might decide.

Section 8 provided that assistant quartermasters and assistant commissaries shall be subject to duties in both departments under the order of the Secretary of War.

Section 9, of this act, provided for two military storekeepers, to be attached to the purchasing department.

No further legislation of Congress affecting the Quartermaster's Department is found until the act of May 18, 1826.

Section 1 of this act made it the additional duty of the Quartermaster's Department to receive from the purchasing department and distribute to the army of the United States all clothing, camp and garrison equipage required for the use of the troops, and required the Quartermaster General, under the direction of the Secretary of War, to prescribe and enforce a system of accountability for all clothing and equipage issued to the army.

Section 2 made it the duty of every company commander, or other officer who should receive clothing and equipage for the use of his command, or for issue to the troops, to render to the Quartermaster General quarterly returns of such supplies, with vouchers according to the prescribed forms, such returns and vouchers, after due examination by the Quartermaster General, to be transmitted for settlement to the proper officer of the Treasury Department.

Section 3 provided for the proper care and preservation of clothing and equipage by the officers having it in charge.

Sections 4 and 5, in order to enable the Quartermaster's Department to carry out the provisions of this act, provided for the appointment of two additional quartermasters and 10 assistant quartermasters, to be taken from the line of the army, to have the same rank and pay as authorized for like grades in the act of March 2, 1821.

The so-called Black Hawk war and the campaigns in Florida had been

successfully met without any great increase of the standing army, forces of militia being called out by several of the States from time to time, to resist Indian encroachments and depredations.

On May 19, 1836, by direction of the President, General Jesup was assigned to the command of the troops of the United States and of the militia which was called into service from Georgia and Alabama for the suppression of Indian hostilities in the Creek country.

By act of July 4, 1836, the President was empowered, during the absence of the Quartermaster General, to assign some other officer of the department or corps to perform the duties of the Quartermaster General.

On January 14, 1837, Major T. Cross, acting Quartermaster General, also strongly urged, in a letter to the Secretary of War, which was transmitted to the Senate, an improved and increased organization for the Quartermaster's Department. At this time the organization of the Quartermaster's Department consisted of one Quartermaster General, four quartermasters (majors), and twenty assistant quartermasters (taken from the line).

Serious questions having again arisen with England, leading to complications on the northeastern frontier, Congress passed the act of July 5, 1838, increasing the military establishment. This act, besides providing a large military force, caused many changes in the various departments of the army.

It authorized the addition of two Assistant Quartermasters General, colonels; two Deputy Quartermasters General, lieut.-colonels; and eight assistant quartermasters with the rank of captain. Provision was made that the pay and emoluments of all officers in the Quartermaster's Department should be the same as allowed similar rank in the dragoons; that all appointments shall be made from the army; that promotion in said department shall take place as in regiments and corps, and that line officers taken for such appointments shall relinquish their rank therein.

By a supplementary act of July 7, 1838, so much of Section 9 of the above act as required assistant quartermasters to be separated from the line was repealed.

General Jesup resumed his duties as Quartermaster General August 5, 1839.

The threatened conflict with England having been avoided, no further increase of the military force or change in the organization and duties of the Quartermaster's Department appear to have been made until the act of August 23, 1842, when the office of Commissary General of Purchases, which had been vacant since the death of Callender Irvine, on the 9th of October, 1841, was abolished, and the duties transferred to the Quartermaster's Department.

MEXICAN WAR.—MAY, 1846, TO JULY 4, 1848.

In May, 1846, war with Mexico was declared, and on the 13th of the same month an act was approved providing for a volunteer force of 50,000 men, and on the 18th of June following an act was approved making certain changes in the military establishment in view of the above action.

Provision was made for such additional officers of the Quartermaster's

Department as the service might require, not exceeding one quartermaster to each brigade, with the rank of major, and one assistant quartermaster, with the rank of captain, for each regiment, to continue in service only so long as their services should be required in connection with the militia and volunteers.

Section 7 provided that promotion in the Quartermaster's Department to the rank of major should thenceforward be made from the captains of the army; that appointments in the line and in the general staff which conferred equal rank in the army should not be held by the same officer at the same time, and that when any officer of the staff who might have been taken from the line had obtained or been entitled to promotion to a grade in his regiment, equal to the commission he might have held in the staff, the said officer should vacate such staff commission, or he might at his option vacate his commission in the line.

On February 11, 1847, an act was approved, increasing the force already authorized, by 10 regiments, each regiment being entitled to a regimental quartermaster, who should be allowed $10 per month additional pay, and forage for two horses for such duty.

Sections 5 and 10 authorized the President to appoint four quartermasters, with the rank of major, and 10 assistant quartermasters, with the rank of captain, to be discharged from the service at the close of the war. This latter clause was repealed by the act of July 19, 1848, which provided, however, that no vacancy which might occur should be filled until authorized by subsequent legislation.

On July 4, 1848, the President issued his proclamation promulgating the treaty of peace between the United States and Mexico.

One of the results of the Mexican War was the vast accumulation of money and property accounts of the disbursing officers who had been engaged in its campaigns. This led to the passage of the act of March 3, 1857, under which all the accounts and vouchers of the disbursing officers of the Quartermaster's Department were to be audited and settled by the third auditor of the Treasury. The same act (Section 2) provided for adding to the Quartermaster's Department five military storekeepers, who were required to file the usual bonds, and who, with those previously authorized, were to be allowed in kind, and in kind only, the fuel and quarters of a first lieutenant of the army.

June 10, 1860, General Jesup died, after a continuous service of forty-two years as chief of the Quartermaster's Department, and on the 28th of the same month Lieutenant Colonel Joseph E. Johnston, 1st United States cavalry, was appointed by President Buchanan, as Quartermaster General, with the rank of brigadier general.

WAR OF THE REBELLION.—FROM APRIL 15, 1861, TO AUGUST 20, 1866.

The organization of the United States Army on January 1, 1861, just previous to the outbreak of the Rebellion, provided for 13,024 officers and enlisted men. After the close of the Mexican War and the disbandment of the volunteer forces called out by that war, the regular troops had been gradually decreasing in numbers, and at the beginning of the Rebellion in

1861, were scattered by companies and detachments throughout the country.

At the commencement of the Rebellion the organization of the Quartermaster's Department was as follows:

One Quartermaster General—brigadier general. Two assistant Quartermasters General—colonels. Two Deputy Quartermasters General—lieutenant colonels. Four quartermasters—majors. Twenty-eight assistant quartermasters—captains, and seven military storekeepers. Total 44.

On the 15th April, 1861, President Lincoln issued his proclamation calling for 75,000 men to serve three months.

On the 22d April, 1861, General Johnston resigned his charge of the Quartermaster's Department, for the purpose of entering the Confederate service, and on the 15th May following, Colonel M. C. Meigs, of the 11th United States Infantry, formerly captain of engineers, United States Army, was appointed by President Lincoln, Quartermaster General in his stead. General Meigs assumed charge of the department on the 13th June, 1861.

On the 3d May, 1861, President Lincoln issued his second proclamation, calling into service 42,034 volunteers to serve three years, if required, and increasing the regular corps by the addition of 22,714 officers and enlisted men.

The acts of July 22 and 25, 1861, following soon after, authorized the increase of the volunteers to 500,000 men during the war; each regiment raised to have a quartermaster (a lieutenant) and a quartermaster sergeant, the latter to have the pay and allowances of a sergeant of cavalry; each brigade was also allowed one assistant quartermaster; the officers and men thus authorized to be placed on the footing as to pay and emoluments of similar corps of the regular army.

On the 29th July following, an act was approved, adding to the regular army 11 regiments for service during the Rebellion; authority being given to reduce the military establishment to 25,000 men within one year after the organized resistance to the authority of the Government ceased, unless otherwise ordered by Congress. This law also provided for regimental and battalion quartermasters and quartermaster sergeants for the new organizations.

On the 3d August, 1861, an act was passed, "providing for the better organization of the military establishment." Section 3 provided for adding to the Quartermaster's Department one colonel, two lieutenant colonels, four majors, and twenty captains, with the rank, pay and allowances of officers of cavalry of like grades. This section also provided that, whenever any captain of the Quartermaster's Department had served 14 years continuously, he should be promoted to be a quartermaster with rank of major.

By section 8, of the act of 5th July, 1862, the President was authorized to increase the number of military storekeepers of the Quartermaster' Department to 12, if the exigencies of the service rendered it necessary. At this time there were only 7 military storekeepers provided for.

On the 17th July, 1862, Congress authorized the acceptance of the services of 100,000 additional volunteers for nine months. Section 10 of this act authorized the addition to the staff of the commander of each army

corps of one chief quartermaster with the rank of lieutenant colonel, to be assigned by the President from the army or volunteer force. Appointments under this act were made of volunteer and regular officers of the Quartermaster's Department; the rank and pay which they thus obtained being temporary, and dependent upon the existence of the corps organization to which they were assigned as chief quartermasters.

On the 25th June, 1864, an act was passed, providing for the examination of certain staff officers, including quartermasters and assistant quartermasters. Boards consisting of three officers, of whom two at least must be officers of volunteers, were provided to conduct the examinations. Officers not appearing for examination within ninety days after being summoned were to be dropped from the rolls, officers not found to possess necessary qualifications to be dismissed with one month's pay.

In accordance with the provisions of this act, the necessary regulations were prescribed in general orders from the War Department, and boards were located at different places. The majority of the officers of the regular and volunteer corps were examined, and those found disqualified were permitted to resign or were dismissed; or, in some cases, were simply mustered out of the service, in view of their having served during the war with such ability as they possessed. The requirements of the law that two of the officers constituting each board should be of the volunteer corps, and the subsequent rapid muster-out of the volunteer organization, rendered the examination of all the officers of the department impracticable, and in accordance with the instruction of the Secretary of War, further action under the law was suspended.

On the 4th of July, 1864, an act was approved providing for the better organization of the Quartermaster's Department. This act established in the office of the Quartermaster General, nine divisions, to exist during the Rebellion and one year thereafter; each division to be placed in charge of a competent officer of the Quartermaster's Department, with the rank, pay, and emoluments of a colonel, under assignment by the Secretary of War, and to perform the duties thus assigned them under such rules as should be prescribed by the Quartermaster General, with the approval of the War Department. Section 7 of this act specified in general terms the business embraced in each of these divisions, and the special duties of the officers placed in charge, under the direction of the Quartermaster General.

Section 3 of this act provides that it shall be the duty of the Quartermaster General to establish depots from time to time, at places convenient to the principal armies in the field, for receiving and distributing the supplies necessary for such armies.

On the 28th of July, 1866, an act was passed increasing and fixing the peace establishment of the United States, and authorizing thereby 60 regiments,—5 of artillery, 10 of cavalry, and 45 of infantry.

Section 13 provided that the Quartermaster's Department of the army thenceforward consist of one Quartermaster General, brigadier general, six assistant Quartermasters General, colonels; ten deputy Quartermasters General, lieutenant-colonels; fifteen quartermasters, majors, and forty-four assistant quartermasters, captains. The vacancies thereby created in the

grade of assistant quartermaster, should be filled by selection from among the persons who had rendered meritorious services as assistant quartermasters of volunteers during two years of the war; but that after the first appointments made under the provisions of this section, as vacancies might occur in the grades of major and captains in that department, no appointments to fill the same should be made until the number of majors be reduced to 12, and the number of captains to 30, and thereafter the number of officers in each of such grades to conform to said reduced numbers.

Section 14 provided for the increase of the number of military storekeepers to 16, if such increase became necessary, and allowed to them the rank, pay and emoluments of a captain of infantry.

Section 15 enacted that the act of July 4, 1864, reorganizing the Quartermaster's Department, and above referred to, continue in force until January 1, 1867, and no longer, and Section 23, that thereafter the Quartermaster General shall be appointed by selection from the corps to which he belongs.

Section 23 also provided that no person be appointed to any vacancy created by the act, in the pay, medical, or Quartermaster's Department until they pass the examination required by the act of June 25, 1864.

While actual hostilities with the Confederate forces practically ceased with the surrender of General Lee, April 9, 1865, General J. E. Johnston, April 26, 1865, and General Kirby Smith, June 2, 1865, it was not until August 20, 1866, that President Andrew Johnson issued his proclamation declaring peace established throughout the whole United States.

The Quartermaster General reports as follows for the fiscal years from 1861 to 1866, inclusive:

The total amount to be accounted for during the fiscal year ending June 30, 1861, was,	$ 10,603 033.75
The total amount to be accounted for during the fiscal year ending June 30, 1862, was,	$176,348,419.60
The total amount to be accounted for during the fiscal year ending June 30, 1863, was,	$375,096,282.27
The total amount to be accounted for during the fiscal year ending June 30, 1964, was,	$581,778,567.08
The total amount to be accounted for during the fiscal year ending June 30, 1865, was,	$732,295,924.68
The total amount to be accounted for during the fiscal year ending June 30, 1866, was,	$571,764,197.87

FROM AUGUST 20, 1866, TO JANUARY 1, 1894.

By Section 7 of the act of March 2, 1867, the rank, pay, and allowances of military storekeepers were made equal to those of captains of cavalry.

On the 1st of January, 1867, the various divisions of the Quartermaster-General's office were abolished, and the officers of the department then assigned to duty in various capacities, with the temporary rank of colonel and major, lost such rank and resumed that held by them previous to such assignment.

Section 6 of the act of Congress approved March 3, 1869, provides, "That

until otherwise directed by law there thall be no new appointments in the * * * Quartermaster's Department. * * *"

On October 11, 1870, the Quartermaster General recommended to the Secretary of War the removal of the restrictions upon appointments to the Quartermaster's Department.

By act approved June 3, 1872, it is provided:

"That the President be, and hereby is, authorized to nominate and, by and with the advice and consent of the Senate, to appoint certain officers of the Quartermaster's Department to the grade they would have held in said department, respectively, had the vacancies created therein by the act of July twenty-eighth, eighteen hundred and sixty-six, from the rank of major to the rank of colonel, both inclusive, been filled by promotion by seniority: *Provided*, that no officer shall be deprived of his relative rank or reduced from his present grade by this act, and that the officers whose appointments are herein authorized shall take rank and receive pay only from the date of their confirmation."

By act approved June 20, 1874, it was provided:

"That the President be, and he is hereby, authorized to nominate and promote William Myers to be Major and Quartermaster, to date from the eighteenth day of January, eighteen hundred and sixty-seven, to take place on the Army Register next below Major J. G. Chandler: *Provided*, that no officer in said department shall by this act be reduced from his present rank, nor shall any additional pay or allowance be made to any officers by virtue of this act."

By act approved March 3, 1875, it was provided:

"That the Quartermasters Department of the army shall hereafter consist of the Quartermaster General, with the rank, pay, and emoluments of a brigadier general; four Assistant Quartermasters General, with the rank, pay, and emoluments of colonels of cavalry; eight Deputy Quartermasters General, with the rank, pay, and emoluments of lieutenant colonels of cavalry; fourteen quartermasters, with the rank, pay, and emoluments of majors of cavalry, and thirty assistant quartermasters with the rank, pay, and emoluments of captains of cavalry.

SEC. 2. That no more appointments shall be made in the grade of military storekeepers in the Quartermaster's Department, and this grade shall cease to exist as soon as the same becomes vacant by death, resignation, or otherwise of the present incumbents.

SEC. 3. That no officer now in service shall be reduced in rank or deprived of his commission by reason of any provision of this act.

SEC. 4. That no officer shall be promoted or appointed in the Quartermaster's Department in excess of the organization prescribed by this act, and that so much of Section 6 of the act approved March three, eighteen hundred and sixty-nine, entitled, "An act making appropriations for the support of the army for the year ending June thirtieth, eighteen hundred and seventy, and for other purposes," as applies to the Quartermaster's Department be, and the same is hereby repealed."

General Meigs was retired from active service on account of age February 6, 1882. On February 13, 1882, Colonel Daniel H. Rucker, Assistant Quartermaster General, was appointed by President Arthur as Quartermaster General. General Rucker assumed the duties of his new office on February 20, 1882, and on the 23d of the same month was himself retired from active service, having reached the limit of age, 64 years.

President Arthur then appointed Col. Rufus Ingalls, Assistant Quartermaster General, as Quartermaster General, to date from February 23, 1882. General Ingalls assumed the duties of his new office March 16, 1882.

By act of Congress approved March 3, 1883, paragraph 4, it is provided that, "hereafter vacancies occurring in the Quartermaster's Department * * * may in the discretion of the President be filled from civil life."

On July 1, 1883, General Ingalls was retired from active service on account of age, and on the same day President Arthur appointed Colonel S. B. Holabird, Assistant Quartermaster General, as Quartermaster General.

Under the act of Congress approved July 5, 1884, it was provided:

"That the Secretary of War is authorized to appoint, on the recommendation of the Quartermaster General, as many post quartermaster sergeants, not to exceed eighty, as he may deem necessary for the interests of the service, said sergeants to be selected by examination from the most competent enlisted men of the army, who have served at least four years, and whose character and education shall fit them to take charge of public property, and to act as clerks and assistants to post and other quartermasters. Said post quartermaster sergeants shall, so far as practicable, perform the duties of storekeepers and clerks, in lieu of citizen employés. The post quartermaster sergeants shall be subject to the rules and articles of war, and shal receive for their services the same pay and allowances as ordnance sergeants."

Under the provisions of this act eighty post quartermaster sergeants have been appointed and assigned to duty at the several military posts and stations, to assist post quartermasters in the performance of their duties in lieu of civilian clerks.

General Holabird, after serving nearly seven years as Quartermaster General, and having reached the age limit, on June 16, 1890, was retired from active service.

By the act approved February 12, 1887, which amends section 1661, R. S., and makes appropriation for arms and equipments for the militia, it is further provided that "the purchase and manufacture of * * * quartermaster's stores and camp equipage for the militia, shall be made the same as provided for the regular army."

Congress, by act approved June 20, 1890, provided: "That the enlisted men known as the artillery detachment at West Point, should be mustered out of the service as artillery-men, and immediately reënlisted as army service men in the Quartermaster's Department, continuing to perform the same duties, and to have the same pay, allowances, rights and privileges, and subject to the rules, regulations and laws in the same manner as if their service had been continuous in the artillery, and their said service shall be considered and declared to be continuous in the army."

This detachment is composed of 117 men, viz.: 1 first sergeant, 6 sergeants, 8 corporals, and 102 privates, and consists of clerks, mechanics, laborers, teamsters and overseers, whose duties are mainly taking care of the buildings and grounds at the Military Academy at West Point, New York.

On June 26, 1890, President Harrison appointed Lieutenant Colonel Richard N. Batchelder Deputy Quartermaster General, as Quartermaster General. General Batchelder assumed duty July 10, 1890, and is the present occupant of the office.

DUTIES.

The Quartermaster's Department provides the means of transportation by land and water for troops and materials of war for the army. It also provides the means of transportation for ordnance and ordnance stores issued by the United States to the several states and territories, and is charged with the duty of purchasing and transporting the quartermaster's stores and equipage for the militia. Upon proper requisition it also transports the property of other executive departments. It provides wagons, ambulances, carts, saddles and horse equipments (except for the cavalry), and harness (except for the artillery).

It also provides vessels for water transportation, builds wharves, constructs and repairs roads for military purposes and builds bridges. Provides and distributes clothing, tents and equipage, and band instruments to the army, and clothing and equipage to the militia. Supplies tableware and mess furniture, fuel, forage, stationery, blank books, lumber, straw for bedding for men and animals, and all materials for camps and for shelter of troops and stores, furniture for barracks, such as bunks, chairs, tables and lockers, heating and cooking stoves, heating and cooking apparatus for use in public barracks and quarters, equipments of bake houses for post bakeries, tools for mechanics and laborers in the Quartermaster's Department, lights, water supply and sewer systems for all military posts and buildings. It hires, purchases and builds barracks, quarters, storehouses and hospitals, provides by hire or purchase grounds for military encampments and buildings, supplies periodicals and newspapers to post libraries. Contracts for horses for cavalry and artillery, cares for and maintains the national cemeteries, and prepares and settles accounts for telegraphing on army business.

The work in the Quartermaster General's office, under its present organization, is distributed among the different branches as follows:

A. *Finance.*—This branch has charge of matters relating to the procurement and distribution of funds, the compilation and preparation for Congress of the annual estimates of funds for the service of the Quartermaster's Department, and for funds required for the Quartermaster General's office; the examination of estimates of funds received from disbursing officers, and the issue of requisitions in favor of such disbursing officers; the action upon settlements made at the Treasury of claims and accounts pertaining to the Quartermaster's Department; the abstracting of weekly and monthly statements of funds for comparison with the Treasury records, and the conducting of the necessary correspondence, and the keeping of the prescribed records and necessary memorandum books connected with the foregoing.

B. *Money and Property.*—The duties of this branch are the administrative examination of the money accounts and returns of quartermaster's stores rendered by officers serving in the Quartermaster's Department, before their transmission to the accounting officers for final action.

It also takes action on certificates of deposit of funds pertaining to the appropriations for the Quartermaster's Department, received from sales to officers and soldiers, sales at auction and other sources, and upon boards of survey and inventory and inspection reports of quartermaster's stores no longer fit for issue or use.

C. *Clothing and Equipage.*—In this branch returns of clothing and equipage are received, registered, and examined. After examination and the correction of

errors they are forwarded to the Second Auditor of the Treasury for final settlement.

D. *Transportation.*—Through this branch the Quartermaster General exercises supervision over all matters pertaining to the transportation of troops and supplies for the army, and for the militia, and settles all accounts therefor which, for any reasons, legal or technical, cannot be paid by the disbursing quartermasters stationed throughout the country, including the accounts of bond aided Pacific roads, estimates for transportation funds, and reports of their expenditure, and replies to all inquiries of Congress, the Court of Claims, and the accounting officers of the Treasury relative to transportation are prepared in this branch. All matters pertaining to Southern railroads indebted to the United States for railway material purchased by them at the close of the war, are adjusted through this branch. Telegraphing on military business and accounts growing out of such service are supervised through the transportation branch. Transportation for the other executive departments is also provided upon requests of their authorized officers and agents.

E. *Regular Supplies.*—This branch has charge of all matters relating to the procurement and distribution of supplies, including means of transportation, stoves, and heating apparatus, and repair and maintenance of same, for heating barracks and quarters; of ranges, stoves, and apparatus for cooking; of fuel and lights for enlisted men, guards, hospitals, storehouses, and offices, and for sales to officers; of cavalry and artillery horses; of equipment of bake houses, to carry on post bakeries; of the necessary furniture, textbooks, paper, and equipment for the post schools; for the tableware and mess furniture for kitchens and mess halls for enlisted men; of forage and bedding for the public animals of the Quartermaster's Department, and for the authorized number of officers' horses; of straw for soldiers' bedding; of stationery and blank books for the Quartermaster's Department, certificates for discharged soldiers, blank forms for the Paymaster's and Quartermaster's Departments, and of the necessary correspondence connected with the work of this branch.

This branch has also charge of matters relating to all contracts to which the Quartermaster's Department is a party.

F. *Clothing Supplies.*—This branch of the office takes action upon all matters pertaining to the purchase and manufacture of clothing and equipage, and of the issues of same to the army, and to the militia of the states and territories in conformity with laws and regulations governing the same.

G. *Barracks and Quarters.*—The work of this branch pertains to providing by hire, purchase, or construction, of barracks, quarters, hospitals, store-houses, stables, roads, sidewalks, wharves and bridges, shooting galleries and target ranges, and generally to all structures furnished by the Quartermaster's Department for the use of the army, including the repairs thereof, and matters relating to post cemeteries, except interments therein, and other miscellaneous duties, among which are the preparation of drawings, specifications, estimates, and studies of various works under the heads enumerated above, and of conducting the necessary correspondence, and keeping the requisite books and records of the transactions pertaining to the work of the branch.

H. *Inspection.*—In this branch cognizance is taken of such matters as relate to the personnel of the officers of the Quartermaster's Department, their assignment to stations, furnishing official bonds, etc., and to matters which pertain individually to clerks and employés in the office of the Quartermaster General and of the Quartermaster's Department at large. All reports, such as the biennial and annual returns of officers of the Quartermaster's Department, and monthly and semi-monthly pay-rolls of clerks and employés in this office, are prepared therein, and action is taken on all

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matters pertaining to the post quartermaster sergeants and the detachment of army service men, Quartermaster's Department, at West Point.

The distribution of books, orders, circulars, and other printed matter intended for the use of officers of the Quartermaster's Department is made from this branch.

I. *Records and Files and Miscellaneous Claims.*—This branch has the custody of the records and files of the office, from the date of its organization, June 15, 1818, and investigates and takes action upon miscellaneous claims for payment for services rendered as mechanics, teamsters, and laborers; for extra-duty pay to enlisted men employed in the Quartermaster's Department; for reimbursement to officers, soldiers, and civilian employés for expenses incurred while travelling on duty or under orders; for the expenses of burial of officers and soldiers; for awards for pursuing, apprehending, and delivering deserters; for recovery of lost and stolen public animals, and such other claims and accounts as do not specifically pertain to other branches of the office.

The branch also has charge of the supply of newspapers and periodicals to military post libraries for the use and benefit of the enlisted men of the army, and of the printing and binding for the Quartermaster's Department, and also all matters relating to claims filed arising under the act of July 4, 1864.

K. *Reservation.*—This branch has charge of title papers to all lands in custody of the War Department for military uses, except such as are designed for permanent fortifications, or for armories, arsenals, and ordnance depots; and of collecting and compiling information in regard to each reservation. It also has charge of all matters relating to water works and water supply, sewerage, plumbing, structural heating, lighting, fire protection, etc., and of conducting correspondence in connection therewith.

National Cemeteries.—This branch has charge of matters pertaining to national cemeteries and the approaches thereto, and the superintendents of same. It exercises a general supervision over the proper disbursement of the funds provided by Congress for the care and maintenance of these cemeteries.

Mail and Records.—This branch has charge of all matters pertaining to the keeping of the records, and briefing, entering, and indexing of communications received in the office of the Quartermaster General, as well as the typewriting and mailing of letters and endorsement.

GENERAL DEPOTS.

General depots have been established at New York City; Philadelphia and Schuylkill Arsenal, Pennsylvania; Washington, D. C.; Jeffersonville, Indiana; San Francisco, Cal., and Saint Louis, Mo.

These general depots of the Quartermasters' Department are established in different sections of the country for the collection, manufacture and preservation of quartermasters' supplies, until they are required for distribution to the army. They are under the immediate control of the Quartermaster General, and the officers in charge act under his sole direction.

At the depots at Philadelphia, Jeffersonville, Ind., and San Francisco, all the clothing for the army is manufactured.

MILITARY PRISON.

By act of Congress approved March 3, 1873, there was established at Rock Island, Ill., a prison for the confinement of offenders against the rules, regulations and laws for the government of the army of the United States.

and subsequently by act approved May 21, 1874, the military prison was transferred to Fort Leavenworth, Kansas.

This prison is governed by a board of five commissioners, consisting of three army officers, and two civilians. The commandant of the prison is an officer of the Quartermaster's Department.

In 1876, the manufacture of boots, shoes, etc., for the army by the convicts of this prison was first commenced and has continued to the present time.

Congress, under existing law of February 27, 1893, limits the amount of the annual appropriation for clothing for the army, that can be expended at the military prison, to $125,000.

Another duty attached to the Quartermaster's Department which resulted from the war, is that relating to burial places for the Union dead.

The act of Congress approved July 17, 1862, provided that the President of the United States shall have power, whenever in his opinion it shall be expedient, to purchase cemetery grounds, and cause them to be enclosed, to be used as a national cemetery, for the soldiers who shall die in the service of the country. During the progress of the war, the sites selected for the interment of the Union dead, who were killed in battle or died in hospital, were usually those the most conveniently located for the purpose.

After the close of the war, Congress by act approved February 22, 1867, provided for the purchase by the United States of sites for national cemeteries. The work of selecting more suitable sites, securing fee simple titles and collecting and transferring thereto the Union dead, scattered over the length and breadth of the land, was assigned to the Quartermaster's Department, and was a labor of great magnitude. This work has been continued under the direction of the Quartermaster's Department until the present time, when there are 82 national cemeteries located either on military reservations, or on land purchased for this purpose and owned by the United States, and which contain 331,755 interments. The national cemeteries are entirely distinct and disconnected from the local cemeteries.

Congress appropriates annually about $161,880 for the care and maintenance of these cemeteries, including the pay of the 72 superintendents.

Under the fostering care of the Government, the national cemeteries have been made attractive, the graves of the Union dead provided with marble headstones, the grounds ornamented and beautified, thus creating a most fitting national monument to the memory of those who gave up their lives that the Union might be preserved.

AMOUNT DISBURSED.

The regular appropriation for the service of the Quartermaster's Department for the fiscal year ending June 30, 1894, is as follows:

Regular Supplies	$2,525,000
Incidental Expenses	650,000
Horses for Cavalry and Artillery	130,000
Barracks and Quarters	700,000
Transportation of the Army and its Supplies	2,600,000
Clothing and Camp and Garrison Equipage	1,200,000

Construction and Repair of Hospitals	$ 50,000
Shooting Galleries and Ranges	8,000
Quarters for Hospital Stewards	7,000
National Cemeteries	100,000
Pay of Superintendents of National Cemeteries	61,880
Total	$8,031,880

ORGANIZATION OF THE ARMY JANUARY 1, 1894.

The United States, under existing orders, is divided into eight military departments, viz.:

Department of the East,
Department of the Missouri,
Department of the Platte,
Department of Dakota,
Department of Texas,
Department of California,
Department of the Colorado,
Department of the Columbia.

The enlisted strength of the army as authorized by existing laws is limited to 25,000 men. There are, besides the staff departments provided by law:

10 regiments of cavalry,
5 regiments of artillery,
25 regiments of infantry.

The organization of the Quartermaster's Department, as provided for under existing laws, is as follows:

1 Quartermaster General, brigadier general.
4 Assistant Quartermasters General, colonels.
8 Deputy Quartermasters General, lieutenant colonels.
14 quartermasters, majors.
30 assistant quartermasters, captains.
1 military storekeeper, captain.
(The last retirement in this grade will occur May 15, 1905, when by operation of the law, the grade will cease to exist.—Act of Congress approved March 3, 1875.)
80 post quartermaster sergeants.

117 army service men, Quartermaster's Department, are on duty at West Point, New York.

In addition to the above there is also an average of 135 officers of the line of the army, who are detailed for duty as acting assistant quartermasters in the Quartermaster's Department at the 94 posts and recruiting depots.

ADMINISTRATION BOARD

was organized in 1883. Its object is to examine into the organization of the clerical force of the office, with a view to increase its efficiency; to recommend changes, promotions and transfers; and to prepare and present a

schedule of pay for the office force. The officers on duty in the Quartermaster General's office compose the Administration Board.

EQUIPMENT BOARD

was organized in 1883. The object of this board of officers is to enable the Quartermaster General to get an authoritative expression of opinion upon current inventions, suggestions, results of improvements, etc., suitable or fit to be introduced into the military service through the Quartermaster's Department, for the quartering, moving, equipment, supply and outfit of all troops in the United States military service. A record of all proceedings is kept, and reports made to the Quartermaster General. The officers on duty in the Quartermaster General's office, and the depot quartermaster, Washington, D. C., compose the Equipment Board.

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THE SEVENTH REGIMENT OF INFANTRY.

By Lieutenant A. B. JOHNSON, 7th U. S. Infantry.

THE Seventh U. S. Infantry was organized under the act of Congress approved July 16, 1798, with William Bently as Lieutenant Colonel Commandant. After an existence of less than two years, the regiment was honorably mustered out of the service on the 15th of June, 1800, under the provisions of an Act approved May 4, 1800.

The regiment was again organized on the 3d of May, 1808, under the act of Congress approved April 12, 1808, with William Russell as colonel.

The first engagement in which any part of the regiment participated, and which is the first battle inscribed on its colors, was at Fort Harrison, Ohio, on September 4th and 5th, 1812. On the 3d of September the fort was attacked by a large band of Indians, who set fire to one of the block houses on the 4th, and followed it up with a resolute attack on the fort, which was then commanded by Captain Zachary Taylor, 7th Infantry, continuing the assault the following day, when the little garrison was relieved from its perilous position by the timely arrival of Colonel Russell, 7th Infantry, with a force of 1100 men.

This engagement was followed by one at Viller's Plantation on the 23d of December, 1814, in which the regiment was conspicuous for its bravery and was highly complimented for its action under fire. This action was followed by the battle of New Orleans, La., on the 1st, 8th and 9th of January, 1815, in which the British lost 293 killed and 1267 wounded, while the American loss was comparatively small.

In the year 1815 the practice of assigning particular states as recruiting districts for the infantry, was discontinued, Kentucky having previously been the district for the Seventh Infantry, as Colorado now is. In the same year the regiment was ordered to Georgia, and its headquarters established at Fort Hawkins, where in accordance with the act of Congress of March 3, 1815, it was consolidated with the 2d, 3d and 44th regiments of infantry to form the present First Infantry; and the 8th, 19th, 36th and 38th were consolidated to form the present Seventh Infantry, its station being changed to Fort Gibson, Arkansas, where it remained for many years. From the Arkansas frontier the regiment was ordered to Florida where it took part in the battle of Fort King, E. Fla., on April 28, 1840; Fort Drane, E. Fla., May 19, 1840; Martin's Point Hammock, E. Fla., December 28, 1840, and Wahoo Swamp, E. Fla., May 17, 1842.

It was not until 1846, when difficulties with the Republic of Mexico assumed a serious aspect, that the Seventh Infantry was concentrated for duty and ordered to Corpus Christi, Texas, and in March of that year was moved to the Rio Grande opposite Matamoras. General Taylor, conscious of the approaching war, began the erection of a large fort defended by extensive works. This was called Fort Taylor. On the 1st of May, 1846, the

larger part of the American forces under General Taylor left for Point Isabel, and the Seventh Infantry, under command of Major Brown, was left to garrison the new fort.

No sooner had the main body of the army disappeared than the Mexicans commenced a spirited bombardment of the earthwork, which was gallantly and successfully defended by the regiment. In this engagement Major Brown received a severe wound, from the effects of which he died on the 9th of May, and in honor of his memory and for the gallant manner in which he and the regiment had acted, the name of the earthwork was changed to Fort Brown, which name it still retains.

The regiment was now much reduced in numbers, and immediately after the siege ten companies were consolidated into six, and placed under the command of Captain D. S. Miles, 7th Infantry, and with this organization it proceeded to Monterey. Here, though under fire, and in the position assigned it, the regiment did not become actively engaged until the action at the Bishop's Palace, when Captain C. F. Smith, of the artillery, was ordered to storm the heights, and Captain Miles, with the 7th Infantry, was ordered to support him. Captain Miles sent Lieutenant Garnett, 7th Infantry, with a detachment of men up the hillside to divert the enemy's attention from Captain Smith's command. Lieutenant Garnett's detachment was met by a vigorous attack of the enemy, but continued to move up, driving the Mexicans before it until the party was recalled. Col. Percifor F. Smith, commanding the 5th, 7th, and the Louisiana Volunteers, gave orders for these commands to pass around on each side and storm the fort which was on the same ridge and about a half mile back, and which commanded the Bishop's Palace. Here a natural rivalry took place between the three organizations, each endeavoring to outstrip and arrive before the other. The three commands entered the gates almost at the same moment, the 5th a little in advance, but followed very closely by the 7th.

The regiment left Monterey December 13, 1846, and arrived at Tampico February 3, 1847, where it embarked for Vera Cruz, landing after a voyage of thirteen days, and joined in the siege of the city and of the castle of San Juan. After a spirited contest the Mexicans capitulated on the 24th of March, 1847.

The Seventh Infantry then, with other troops, took up the line of march toward the interior, frequently skirmishing with the enemy at various points, and on the 15th of April arrived at Cerro Gordo, where the Mexicans were found to be strongly intrenched. The regiment, under the command of Lieutenant Colonel Plympton, and three companies of the 3d Infantry, were detailed to storm the heights of Cerro Gordo, which feat was performed with brilliant success, both colors of the regiment being planted on the enemy's works. Sergeant Henry, 7th Infantry, with his own hands hauled down the national standard of Mexico from the fort, and was recommended for a commission by General Scott for this and his well-known intrepidity on former occasions. General Scott in his official report said, "The highest praise is due to Colonel Plympton, 7th Infantry, and the gallant officers and men of the regiment for their brilliant service." After this victory the troops continued the onward march to Jalapa, where they went into camp.

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On the 19th of August, at Contreras, the brigade of which the 7th Infantry formed a part commenced the movement at sunrise, and after a tedious march reached an elevation in rear of the enemy, stormed the intrenchments, carried their works and planted their colors upon them, capturing a large number of prisoners and ammunition. At this juncture relief was required for the troops in front of Cherubusco, and the 7th Infantry being detached for their relief, moved rapidly, joined in the assault and participated in the handsome action at that place on August 20, 1847.

On the 12th of September a call was made for a captain, a lieutenant and a detachment of enlisted men from the 7th Infantry, to join with similar details from other troops, in forming a storming party for the attack of the works of Chapultepec. Captain Gabriel R. Paul and Lieutenant Levi Garnett, 7th Infantry, with a detachment of enlisted men, volunteered their services. The party formed at once and marched to Tacubaya, under the command of Captain Silas Casey, 2d Infantry. At nine o'clock in the evening Captain Paul moved out near the enemy's works, when a brisk engagement took place, resulting in the defeat and retreat of the Mexican pickets. At daylight on the 13th the entire party moved forward under command of Captain Paul, 7th Infantry (Captain Casey having been wounded), who led the attack and carried the works, capturing five pieces of artillery and 450 prisoners. Lieutenant Garnett was killed in the assault. On the 14th of September the regiment with colors proudly flying marched into the City of Mexico, where it remained until the ratification of the treaty of peace.

After the treaty of peace with Mexico, the regiment was ordered to Florida, where it remained until June, 1850, when it was ordered to Jefferson Barracks, arriving there in July. After a short stay of a few weeks, it was ordered on the 13th of August to New Mexico, embarking the following day and arriving at Fort Leavenworth on the 18th. Here it remained fitting out and mounting Companies C, D, F and H, in accordance with orders from the War Department, until September 15th, when the entire regiment took up the line of march for New Mexico. On the 1st of October the command had reached the crossing of the Little Arkansas, 210 miles from Fort Leavenworth, when orders were received by courier countermanding the order and directing the return of the regiment to Jefferson Barracks, where it arrived on the 21st, and remained until the following spring. It was then ordered to relieve the 5th Infantry in its several stations on the Arkansas frontier, arriving there several weeks later, and remaining on this frontier building posts, making roads and protecting the few white settlers from the Indians, until 1858, when it was ordered to rendezvous at Jefferson Barracks for service in Utah against the Mormons.

The troops composing the Utah expedition were formed into six separate columns, the 7th Infantry being posted in the 4th, 5th, and 6th. After a long and tedious march of 1200 miles over an uninteresting and monotonous country, the several columns took position by regiments at Camp Floyd, Utah, in September, the last column arriving September 25th. Here the regiment remained until April, 1860, when it was ordered to take station in New Mexico, arriving at Santa Fé in August, from which point it was sent to various posts in the Territory.

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Early in the spring of 1861, orders were issued to break up Fort Buchanan, join the troops of the post (Companies C and H, 7th Infantry) with the companies at Fort Breckenridge, and march the command to reinforce the troops on the Rio Grande. During this period many important events were taking place. Actual warfare had already begun between the North and the South. The attack upon Fort Sumter, several skirmishes, and the battle of Rull Run, had already occurred, although the forces in Texas and New Mexico had received but partial intelligence of these events. The Seventh Infantry, with a view to a change of station to the States, had been ordered to concentrate at Fort Fillmore, then commanded by Major Isaac Lynde, 7th Infantry. Here all was doubt and anxiety. No authentic information of the intended policy of the Government had been received, and the mail and couriers brought only the sad news of the continued secession of the States, and the general inertness and doubtful course of the Government.

In July, the Headquarters and Companies A, B, D, E, G, I and K, had assembled at Fort Fillmore awaiting the arrival of Companies C, F and H from Forts Craig and Buchanan. Scouting parties from Fort Bliss, where the Confederates were concentrating troops, had ventured within twenty miles of Fort Fillmore, and on one occasion Major Lynde had sent several companies of the regiment to drive back these parties, but none were ever found. On the 18th of July Companies E and G of the regiment, under command of Captain Joseph H. Potter, were sent to occupy the town of San Thomas, on the opposite side of the river and about two and a half miles from the post, for the purpose of guarding the ford. On the evening of the 23d, Major Lynde, hearing that the enemy was about to advance upon the fort, immediately ordered Captain Potter to abandon San Thomas with his two companies and hasten back.

The Confederates, meeting with no resistance at the ford, crossed on the morning of the 25th into San Thomas, and then leisurely marched into the town of Mesilla, about two miles from the post. On the night of the 24th, when all the garrison were sleeping peacefully, with no more than the customary number of sentinels, no pickets out in any direction, no precaution whatever taken to prevent surprise from an approaching enemy, a body of Texas troops commanded by Lieutenant Colonel Baylor, C. S. A., to the number of about 250, were quietly encamped within six hundred yards of the fort, intending to surprise it at daybreak on the morning of the 25th, kill or capture the officers in their quarters, and then take the men prisoners in their barracks. Fortunately for the command, one of the Confederate pickets,—an old discharged soldier,—deserted from his post, came in and alarmed the garrison, otherwise their success would have been complete. The troops were at once put in readiness to withstand an attack, but the Texans drew off, returning to Mesilla.

The troops of the garrison were finally (about 4 o'clock P. M.) ordered out for the purpose of marching into Mesilla, the force consisting of Companies B, D, E, G, I and K, 7th Infantry, and two companies of the mounted rifles. When within 500 yards of the town, Lieutenant E. J. Brooks, the regimental adjutant, and Assistant Surgeon McKee, rode forward with a flag of truce toward the enemy's lines, and as they did so, two mounted men

advanced to meet them, each having a double-barrelled shot-gun on his saddle. Lieutenant Brooks in the name of his commander demanded "an unconditional surrender of the forces and town," to which one of the men replied, "If you want the town come and take it." Orders were at once given by Major Lynde to advance and attack the enemy. Lieutenant Crilly, 7th Infantry, in charge of the two field pieces, was ordered to shell the town, which was full of women and children. Dr. McKee says that he heard Major Lynde order Lieut. Crilly to fire a shell at a group of women and children, and so, without having, in accordance with the humane rule of civilized warfare, given notice to remove the women and children to a place of safety, shells were thrown into different parts of the town, fortunately injuring no one. Night coming on, the command was withdrawn, returning to the post about 10 P. M., having lost three men killed and twelve wounded.

The next day Major Lynde ordered the post abandoned and the public property destroyed, and at 1 A. M. on the morning of the 27th of July took up the line of march for Fort Stanton. By daylight the command was eight or ten miles on the road to San Augustine Springs. The day being extremely hot and there being no water, many of the men dropped out almost dead from fatigue and thirst. The Texans pursued the troops as soon as possible, the only temporary security and intervening guard being the company of Rifles under Captain Gibbs, which was deployed as skirmishers, covering the retreat. Dr. McKee says, "About noon I drove into camp at San Augustine Springs, found the troops in camp, and Lynde enjoying a comfortable lunch, as if nothing was going on. It was the sublimity of majestic indifference, his gray hair and beard forming a fitting frame for his pale face and cowardly soul." In a short time the Texans were seen advancing in line of battle to the number of some 300, Lynde's command numbering nearly 500 well trained and disciplined troops and forming a striking contrast to the badly armed and irregular command of the Texans. The enemy advanced within 300 yards, when Major Lynde sent out a flag of truce, and at once commenced negotiations for surrendering his command, which was accomplished in a very short time. When the officers heard of it they waited upon Major Lynde, and each in turn gave in his protest, but it was of no avail. Was ever such a blemish and stigma attached to a regiment whose record had hitherto been full of glory wherever it had been placed? The colors of the regiment were cut from the staff, torn into pieces, and distributed to those who had fought under them in years gone by and who loved them as they loved life. To any unprejudiced mind this action on the part of Major Lynde must seem hasty and unjust towards the command, and unwarranted when it is considered that no opportunity was afforded the men to prove their courage. No matter what the ultimate consequences might have been, it certainly would have been more soldier-like and vastly more loyal to have tried to have beaten the enemy, and then, if overpowered, to have surrendered, than to have surrendered without a shot to a force inferior in numbers, in discipline, in *esprit-de-corps*, and indeed vastly more poorly armed.

On the 19th of July the troops left San Augustine Springs as prisoners

of war, arriving at Las Cruses, N. M., the same night, where on the 30th and 31st, they were paroled. The Headquarters, Band and Companies A, B, D, E, G, I and K, left Las Cruses on the 3d of August, en route to Fort Union, arriving at Fort Craig on the 10th. Upon their arrival there, Company F, together with the rest of the garrison, turned out and presented arms to the prisoners of war as they marched into the post. So great was the feeling toward Major Lynde, that he was not allowed to enter the garrison. This disastrous and disgraceful affair occurred July 20, 1861, and after due consideration Major Lynde was summarily dismissed from the service by order of President Lincoln, and ceased to be an officer of the army November 25, 1861. Five years later (November 27, 1866), President Johnson revoked the order of President Lincoln, and thus restored Major Lynde to duty to date July 28, 1866; and on the same date placed him on the retired list.

Companies C, F and H escaped capture by returning at once to their respective posts. The seven surrendered companies remained at Fort Union until the 18th of August, when they were ordered to Jefferson Barracks, arriving there early in November. Here they remained until December, when they were sent to posts along the northern lakes.

Having escaped the unfortunate fate of the remainder of the regiment, Companies C, F and H, were concentrated at Fort Craig. On the 21st of February the severe battle of Valverde was fought in which Companies C, F and H participated. Company F was decimated and both the others lost heavily. Captain Bascom, 16th Infantry, recently promoted from the 7th, was killed in the action while commanding Company C. The three companies lost one officer, two sergeants and sixteen privates killed; three sergeants, two corporals and thirty-four privates wounded, and four privates taken prisoners; making an aggregate loss of sixty-two.

On the 30th of September, 1862, the companies that had been surrendered were declared released from parole, and in October were ordered to join the regular brigade in the Army of the Potomac, arriving at camp near Sandy Hook, Md., on the 31st. Leaving on the 1st of November, they crossed the Potomac River at Harper's Ferry, went into camp at Snicker's Gap on the second, and formed part of the reconnoisance on the 3d. On the 6th they went into camp near Middlebury, Va., and on the 23d encamped near Potomac Creek.

The brigade of which the 7th Infantry was a part, left camp on Potomac Creek at daylight on the 11th of December and marched to a point near Falmouth, Va., where it bivouacked under cover of some ravines. It remained in this position until about 4 P. M. on the 13th, when the march was resumed, the brigade crossing the Rappahannock River on the upper bridge, passed through Fredericksburg and was placed in position on the south side of the city and on the east side of Hanover Street. This took place at about 5.15 P. M. under a heavy fire of musketry, and in taking up this position, eight men were killed. About 11 P. M. the brigade advanced about a third of a mile, and relieved a part of the advanced guard of the army. The position proved to be a most trying one, and eventually put the nerve and endurance of the oldest and most courageous of the officers and men to the severest

test. The line was now about eighty yards in front of a stone wall, behind which the enemy was posted in great numbers, while the slope occupied by the troops was so slight as to compel the men to remain flat on their faces from earliest dawn until darkness again veiled them from sight. Thus the troops remained for twelve long hours, unable to eat or drink, for so relentless was the enemy that not even a wounded man nor a litter-bearer was exempted from their fire. At 11 P. M. on the 14th, the command withdrew and marched back into the city, bivouacking in the streets during the night, crossing the Rappahannock River on the 16th, and returning to camp near Falmouth on the 17th. In this fight the 7th Infantry lost two men killed, twenty-six wounded, and nine missing, this being the heaviest loss of any regiment in the brigade.

On the arrival of the regiment in New York in November, 1861, the regimental commander applied to the War Department for a set of colors to replace those destroyed at the surrender, but another set was refused until the regiment had won them by deeds of valor on the field of battle. Accordingly, in January, 1863, a set of colors was sent to the regiment for its gallantry in the battle of Fredericksburg, and the presentation was made with suitable honors.

The brigade of which the 7th Infantry formed a part left its encampment near Chancellorsville on the morning of May 1st, advancing on the Fredericksburg road. Having advanced a couple of miles, the enemy was discovered in front, and orders were at once given to deploy the brigade in line, with a regiment as skirmishers in front, and await instructions. The troops were at once deployed, the 7th Infantry being on the left of the road. Finding the position much exposed to the shells from the enemy's batteries, the line was advanced to the bottom of the hill to a fence bordering a small stream which ran along the front of the line on the left of the road. Orders were soon received to advance to the crest of the hill. This was stubbornly opposed by the enemy, but the advance of the line was irresistible. The enemy fled or were captured, and in a few minutes the brigade occupied the crest of the hill. Having gained this position, orders were received to hold it at all hazards and a disposition of the troops most favorable for the purpose was made accordingly. After holding this position for an hour without any serious molestation, orders were received to retire. The troops were accordingly withdrawn slowly in line of battle and in good order, occasionally facing about and fronting the enemy, the wounded at the same time being carefully removed to the rear. In this fight at Chancellorsville, the regiment lost two enlisted men killed, nine wounded and five missing.

The regiment left camp on the 4th of June and proceeded to Benson's Mills near the Rappahannock River, leaving there on the 13th, and reaching camp near Union Mills on the 30th. After leaving the Rappahannock and making the usual marches incident to following an advancing army, some of them being unusually severe, the regiment arrived in front of the enemy at Gettysburg, and at once was formed in line on Round Top, at about 5.30 P. M. and immediately advanced down the hill and across an open field. Shortly after, that portion of the brigade that the 7th Infantry was in was ordered to cross the stone fence near them, wheel to the left, form in

a line perpendicular to the original direction, and advance into the woods. This was immediately done, relieving time a brigade already there.

After remaining faced in this new direction for a few minutes, the enemy became visible upon the right. At this juncture the regiment was ordered to retire slowly, which order was obeyed with great reluctance by the men. While they were retiring, the fire of the enemy became very destructive, and after recrossing the stone fence into the open field, it became frightful, the regiment receiving a fire from three different directions. After reaching the hill, the regiment was halted and remained in that position, being engaged no more during the operations. Although the loss during the engagement was heavy, the regiment fell back in good order and could account for every man. Of the 116 officers and men who went into action, the regiment lost one officer and eleven men killed; three officers and forty-two men wounded, and two men missing; being a loss of 50.86 per cent., far in excess of that of the famous Light Brigade at Balaklava.

The regiment left Gettysburg on the 6th of July in pursuit of the enemy, crossing the Potomac River near Berlin, Md., on the 17th, and was present and engaged in the fight at Wapping Heights, Va., on the 27th of July. It resumed the march on the 27th, and arrived at camp near Beverly Ford on the 6th of August, where it remained until the 14th, when orders were received to proceed to New York City, to assist in quelling the draft riots, where it remained until May, 1865, when it was ordered to Florida.

Here the regiment remained during the reconstruction period, until April, 1869, when it was ordered to the Department of the Platte, and consolidated with the 36th Infantry, under its old designation. In this Department the regiment remained until the following spring, when it was ordered to Montana, with headquarters at Fort Shaw.

On the 20th of October, 1871, Companies B and H, under the command of Captain H. B. Freeman, 7th Infantry, left Fort Shaw en route to old Fort Belknap, M. T., for the purpose of breaking up the camp, and driving out of the country, a party of half-breeds from Canada, who were engaged in illicit traffic in whiskey and ammunition with the Indians. The command struck the half-breed camp on the 2d of November, capturing and burning their supplies and ordering them out of the country. Here it remained until the 16th, when it broke camp en route to Fort Shaw. On the 24th, about noon, the command was overtaken while on the march, by a most terrific storm. The weather, which had hitherto not been unusually cold, suddenly changed to many degrees colder,—a violent northwest wind accompanied with snow coming on before the command could get into camp, and nearly one-half of the men had their hands and feet frozen, some of them very severely, ten of whom were compelled to have amputations performed.

On the 13th of July, 1872, Companies C, E, G and I, under the command of Captain C. C. Rawn, left Fort Shaw as part of the force organized for the protection of the engineers of the Northern Pacific Railroad, in their surveying expedition down the Yellowstone River. On the 1st of August the command broke camp, continuing its march without incident until the 12th, when it arrived about twelve miles below the terminus of the survey

of the previous year. On the 13th the command remained in camp near Pryor's Fork. At about 2.45 A. M. on the morning of the 14th the camp was attacked by a war party of Sioux and Cheyenne Indians. The troops were immediately deployed and then advanced steadily, driving the Indians out of the timber and occupying it. The fire was kept up from this time until 7.30 A. M., when the Indians withdrew. From the darkness of the morning it was impossible to estimate correctly the number of Indians engaged, but it has been estimated at from 400 to 800. Only two bodies were found, the gloom enabling the Indians to carry off their wounded and slain. The companies lost two killed and ten wounded. After the Indians had retreated, the march was continued down the Yellowstone, but no further trouble was made that year by the Indians.

On the 2d of June, 1874, Companies G and K, under Captain G. L. Browning, were ordered to old Fort Lewis, Montana, for the purpose of protecting travellers and wagon trains over the Carroll road, between Camp Baker and Carroll, arriving on the 25th. On the 7th of July a war party of from fifty to eighty hostile Sioux made their appearance within a mile of Camp Lewis, firing upon a fatigue party procuring wood for the camp, and also upon a small number of recruits who were fishing in the creek near the wood party. A detachment of mounted men from the two companies, under Lieutenant Wright, 7th Infantry, proceeded at once to the scene of the attack, followed by the companies under Captain Browning. The Indians being mounted on fleet ponies and the companies on foot, they were unable to intercept them. The mounted men however followed on the trail and overtook them in a ravine about fifteen miles from camp, immediately opening fire upon them, which was returned by the Indians. After a sharp skirmish of a few minutes, the Indians fled. The detachment recaptured eight head of stock which had been run off from a ranch near camp. The horses of the detachment being too much jaded to follow the Indians any further, the command returned to camp. Three unassigned recruits were killed in this affair, one of whom was scalped. Private Davis, Company G, was severely wounded in the right hand, while bravely defending himself with his fishing pole, that being his only means of defense.

On the 17th of March, 1876, Companies A, B, E, H, I and K, 7th Infantry, were ordered to concentrate at Fort Ellis, as a part of a column to operate against the hostile Sioux Indians, reaching that post on the 28th. Here the command was augmented by four troops of cavalry, and left Fort Ellis on the 30th, under command of Colonel John Gibbon, 7th Infantry, whose instructions were to guard the left bank of the Yellowstone River, and if possible prevent the Indians from crossing the river, in case they should attempt to do so, either in pursuance of their habit of following the buffalo to the north, or in case they should seek to avoid the troops coming against them from the south and east. After marching and counter-marching up and down the Yellowstone, Colonel Gibbon, in accordance with orders from General Terry, put his command across the Yellowstone and went into camp on the 24th of June, this being part of a plan to surround the Indian village on the Little Big Horn River, while General Custer with the 7th Cavalry was to march up the Rosebud River until he struck the Indian

trail, and the two columns were to attack the village at the same time and from opposite directions.

On the morning of the 25th, Gibbon's command (General Terry being with it) broke camp, making a march of twenty-eight miles, over heavy mountain trails without any water, the day being very hot, and the men suffering greatly with thirst. In order that scouts might be sent out into the valley of the Little Big Horn, the cavalry, with the battery and a mounted detachment of the 7th Infantry commanded by Lieutenant Bradley, was pushed on thirteen miles further, not getting into camp until midnight. Scouts were sent out at half-past four in the morning of the 26th, who shortly afterwards brought in news that they had encountered some Indians, and had run them across the river. They proved to be Crow scouts which had been sent with Custer's command, and when they discovered that their pursuers were soldiers, they called across the river that Custer's command had been entirely destroyed by the Sioux, who were chasing the soldiers all over the country and killing them. The column now pushed up the valley of the Little Big Horn, as rapidly as the men could march, halting and bivouacking on the open prairie about dark, having marched thirty-three miles since morning.

Very early the following morning the advance was resumed, and after proceeding about three miles, a large deserted Indian camp appeared. Many lodge poles were still standing, and the quantity of property scattered about testified to the hasty departure of the Indians. While passing through the Indian camp, Lieutenant Bradley rode up to General Terry and reported that he had counted 194 dead soldiers in the foot hills to the left. Communication was soon opened up with Major Reno, whose command was found intrenched upon the tops of several small ridges with fifty-eight wounded lying on the hot dusty hill tops, where, until about 6 o'clock on the evening before, they had been unable to obtain any water except at the imminent risk of life. Colonel Gibbon's command was at once put into camp and arrangements made to bring down and properly care for the wounded, which was effected by night-fall.

The next day was occupied in burying the dead and in constructing litters for transporting the wounded. With these litters carried on the shoulders of the men of Companies H and I, 7th Infantry, the command left camp at sunset, but the march was exceedingly slow and tedious, and it was long after midnight when camp was reached, having marched only about four and a half miles. Progress with the hand-litters having proved so exceedingly slow and tedious, it was thought best to discard them and try some mule litters, which worked so admirably that the command was enabled to start that evening about six o'clock. After proceeding a few miles, information was received that the steamer *Far West* was at the mouth of the Little Big Horn, waiting for the command, and accordingly General Terry directed the command to push on with a view to placing the wounded on the boat, where they could have comfort and the best attention. This was safely accomplished about two o'clock on the morning of the 30th.

Soon after the disaster to Custer's command, General Terry made attempts to communicate with General Crook's column, which was somewhere

in that vicinity, in order that concert of action might be established between the two columns. A reward of $250 was offered to any citizen who would carry a dispatch through to him. A scout started out but was driven back by the Indians. A reward of $500 was then offered with a like result. At last the General called for volunteers, and twelve enlisted men came forward volunteering to go. From these twelve men three were selected, who left camp on the 9th of July, reaching General Crook's camp on the 12th, and returned safely on the 25th. General Terry published the following order to the command:

"The Department Commander has recently had urgent occasion to communicate from this camp with Brigadier General Crook, commanding a force on the headwaters of Powder River. The duty of carrying dispatches between these points, through a country occupied by a large force of hostile Sioux, was one of the most arduous and perilous nature. A scout, inspired by the promise of a large reward, made the attempt, but soon abandoned it as hopeless. As a last resort a call was made upon the troops of this command for volunteers, in response to which not less than twelve enlisted men promptly offered their services. From among them the following named soldiers were selected,—Privates James Bell, Benjamin H. Stuart, and William Evans, of Company E, 7th Infantry. On the 9th day of July they set out for General Crook's camp, which they reached on the 12th, delivered the dispatches, and returned, arriving in camp on the 25th. In making this public acknowledgment of the important service voluntarily rendered by these soldiers at the imminent risk of their lives, the Department Commander desires to express his deep regret that at present it is not in his power to bestow the substantial reward which has been so well earned, but he is confident that an achievement undertaken in so soldierlike a spirit and carried so gallantly to a successful issue, will not be permitted to pass unrewarded. The exploit is one calculated to establish in the public mind a higher and more just estimate of the character of the United States soldier. The Department Commander, on his own behalf, and on behalf of the officers of this command, desired thus publicly to thank Privates James Bell, Benjamin H. Stuart, and William Evans, Company E, 7th Infantry, for a deed which reflects so much credit on the service." These men were eventually granted medals by Congress.

After consolidating with General Crook's command, and making many long and hard marches, orders were issued on the 5th of September for the troops to return to their several stations, which they hailed with delight. During the period from March 17 to October 7, the companies of the 7th Infantry marched nearly 1700 miles and were in the field six months and nineteen days.

In July, 1877, word was received at Fort Missoula, Montana, that a large party of hostile Nez Perce Indians under Chief Joseph were coming over the "Lo Lo" trail in their efforts to escape from General Howard's troops who were pursuing them. Captain C. C. Rawn, 7th Infantry, then in command, at once took steps to head them off, but the wily savages eluded him and escaped around his position taken in their front.

Upon the receipt of a dispatch from General Howard that the hostiles

had started over the "Lo Lo" trail, Colonel Gibbon, 7th Infantry, concentrated four additional companies of the regiment at Fort Missoula, and on August 4, left that post with Companies A, D, F, G, I and K, in pursuit of the Indians, making 25 miles the first day. The following day a march of 30 miles was made, during which quite a number of citizens joined the command, who volunteered to act as scouts and who desired to assist in case of a fight. After following the hostiles for three or four days longer, they were discovered on August 8 camped in the Big Hole Basin, and the troops took position, all lying down to await daylight. Here they remained for several hours, in plain hearing of the barking of dogs, the crying of babies, and other noises of camp. The Indian camp was pitched on the south bank of the Big Hole River, in an open meadow partially surrounded by dense thickets of willows. There were 89 lodges, pitched in the form of a V, with the apex up stream.

It was now nearing daylight, and the men suffered with cold, as they had neither blankets nor overcoats, having left them with the wagon train in the rear. The smouldering camp-fires flickered fitfully in the pale starlight, and the smoky lodges of the savages presented a most fantastic picture as the dying lights blazed with ever-changing weirdness upon them. Finally the night ended, and as the day approached from behind the eastern hills, the troops were again astir, but their movements were as silent as the grave. Under whispered orders and with stealthy tread the companies took position. As the light increased and the men were advancing cautiously, an Indian rode out of the willows directly in front of Lieutenant Bradley's position, en route to the pony herd on the hillside, and was instantly shot. The entire line at once advanced on the village; volleys were fired into the tepees, and with an eager yell the whole line swept wildly into the midst of the slumbering camp. The Indians, completely surprised, rushed from their lodges panic stricken by the suddenness of the attack, running for the river banks and thickets; squaws yelling, children screaming, dogs barking, horses neighing, many breaking their lariats and stampeding. For a few minutes no effective fire was returned, but as soon as the Indians recovered from their surprise, they opened fire upon the troops with terrible effect. In less than twenty minutes the troops had possession of the camp and orders were given to set fire to it.

The Indians, however, had not given up the fight, and while a portion of the command was setting fire to the tepees, the other portion was occupied in replying to the shots, which now came upon them from every direction. At almost every crack of the rifle from the distant hills, some member of the command was sure to fall. The troops were now formed into two lines, back to back, and the order was given to charge through the brush in opposite directions, for the purpose of driving out the Indians who remained there, but they simply retreated further into the woods. In this part of the action Lieutenant Coolidge (now Captain) while gallantly leading his company, was shot through both thighs, and was carried to a place of safety by 1st Sergt. Patrick Rogan, to whom Congress awarded a medal for bravery in this engagement.

It soon became evident that it was not prudent to attempt to hold the

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position in the river bottom any longer, and the order was given to fall back to the hills, which was done, with all the wounded. Here they replied with good effect to the sharpshooters who were gathering around them, and here Lieutenant English received his death, and Captain Williams a severe but not fatal wound. The Indians crawled up as closely as they dared, and with yells of encouragement urged each other on, but the troops met them with a bold and determined front, their fire being very destructive to the enemy. While in this position the Indians attempted to fire the grass, and smoke the troops out, but fortunately it was too green, and would not burn.

At ten o'clock on the following morning General Howard arrived with part of his command, and thus saved from entire annihilation the remainder of the regiment, which surely would have been wiped out had it not been for this timely reinforcement. In this fight the regiment lost 22 killed and 35 wounded while the enemy acknowledged to have lost 208. Among those killed was Captain Logan and Lieutenant Bradley, and among the wounded were Colonel Gibbon and Lieutenant Woodruff.

On the morning of the 13th, the command started for Deer Lodge, reaching it on the 15th. Here the greatest care was given the wounded by the citizens, and everything done for their comfort. From here the companies went to their respective stations, taking with them such of their wonded as were able to travel.

The regiment remained in Montana until September, 1888, when the Headquarters, Band and Companies B, C, E, F, H and K, left for Fort Snelling, Minnesota, and took station there and were followed by Companies A, D, G and I, in October of the following year.

Companies B, C, E, F, H and K, under the command of Lieut. Colonel Charles C. Gilbert, 7th Infantry, left Fort Snelling on October 1, 1889, for service against the hostile Utes on White River, Colorado, who on the 29th of September had ambushed Major Thornburg's command, killing him and many of his men. The companies left the post within two hours after receiving the order, and arrived at the camp on White River, October 14th. Here they remained until June 11, 1880, when they were ordered back to Fort Snelling, from which point they were distributed to several posts in the Department.

Here the regiment remained until November, 1882, when it was ordered to the Department of the Platte, with its headquarters at Fort Laramie, Wyoming, remaining until October, 1889, when it was ordered to Fort Logan, Colorado, at which are at present eight companies of the regiment. The regiment participated in the Sioux War of 1890-91, returning to Fort Logan in January, 1891.

This regiment has the unusual distinction of having had a colonel,—Matthew Arbuckle,—longer than any regiment in the world, viz., from March 16, 1820, to June 11, 1851,—over thirty-one years. It has had many men of note and mark on its rolls, such as Zachary Taylor, U. S. Grant, B. L. E. Bonneville, the explorer, Joseph H. Potter, Gabriel R. Paul, Cadmus M. Wilcox, Gabriel I. Raines, John Gibbon and others; and for the past few years has stood at the head of the army in marksmanship.

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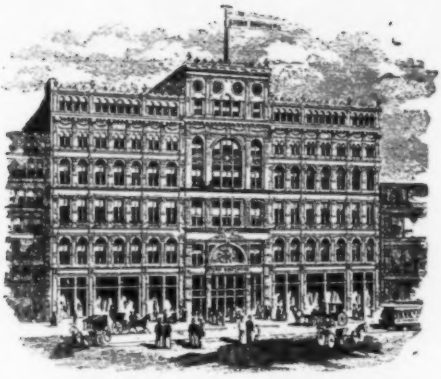

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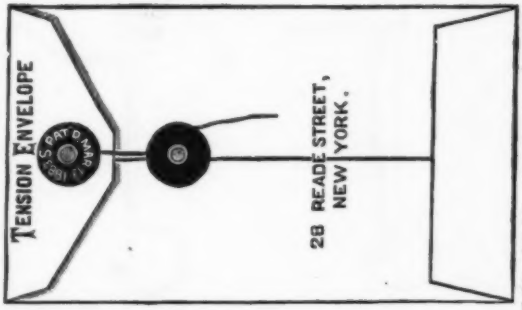

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Dr. J. J. Sullivan, of New York City, in his "Diet After Weaning," says:

As a rule the weaning of a child should be commenced when the process of teething is fairly established. As soon as nature provides the child with teeth it is better for both mother and child that it be weaned. The infant should not, however, be weaned from the breast in too sudden a manner, as any abrupt change of diet is very apt to derange the digestive organs and give rise to diarrhœa or cholera infantum.

The diet of infants at this particular period of life has received a large share of professional attention during the past ten years. Foods of various kinds have been introduced into the market, and I have thoroughly tested them all. I have found Schumacher's Infant Food to be the most perfect and rational food that has ever been introduced to the profession. It has by far the largest percentage of albuminoids—brain and muscle making material. It is palatable, nutritious, and wholesome, and does not overtax the digestive organs of young children, producing those disturbances of the stomach that usually attend the early months of life. It acts not only as a food, but as a corrective medicine, and prevents those troubles of the bowels known as colic, summer complaint, etc.

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STRONGEST. PUREST. BEST.

Keep a cake of Ivory Soap at the stable, it is most excellent for washing galled spots and scratches on horses, for it will cleanse without irritating, and the vegetable oils of which it is made are cooling and healing in effect.

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There are many white soaps, each represented to be "just as good as the 'Ivory';" they **ARE NOT**, but like all counterfeits, lack the peculiar and remarkable qualities of the genuine. Ask for "Ivory" Soap and insist upon getting it.

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Such powders, if used in baking, are a vexation. They do not make nice bread, biscuit or cake, but spoil good flour, butter and eggs, and produce impure, unwholesome food.

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